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MANORAMA

TELL ME WHY

No:142

ELEMENTS

THE SIMPLEST THINGS THAT FORM ALL THINGS

			13 26.982 Al ALUMINIUM	14 28.086 Si SILICON		
		30 65.38 Zn ZINC	31 69.723 Ga GALLIUM	32 72.64 Ge GERMANIUM		
	47 107.87 Ag SILVER	48 112.41 Cd CADMIUM	49 114.82 In INDIUM	50 118.71 Sn TIN		
78 195.08 Pt PLATINUM	79 196.97 Au GOLD	80 200.59 Hg MERCURY	81 204.38 Tl THALLIUM	82 207.20 Pb LEAD		
108 (277) Hs HASSIUM	109 (276) Mt MEITNERIUM	110 (281) Ds DARMSTADTIUM	111 (280) Rg ROENTGENIUM	112 (285) Cn COPERNICIUM	113 (284) Nh NIHONIUM	114 (289) Fl FLEROVIUM

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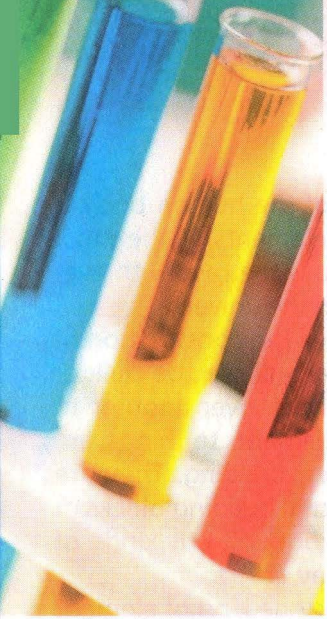

MANORAMA
TELL ME WHY
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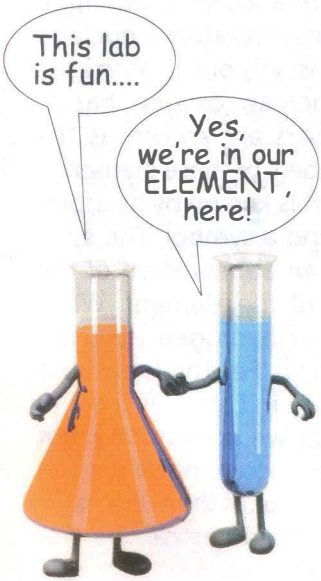
FROM THE HOUSE OF MAGIC POT, THE WEEK, MANORAMA YEARBOOK, VANITHA & THE MALAYALA MANORAMA DAILY



ALL ABOUT ELEMENTS

Xu Fu, the renowned alchemist in Ancient China, once came up with an elixir for immortality. The Emperor of China who longed to be immortal, consumed the medicine first. But to everyone's dismay, the emperor turned insane, and eventually died. The cause of death was nothing but Xu Fu's secret medicine itself - mercury, a toxic element.

Once used as a medicine, the element mercury is toxic enough to take one's life. But not all elements are toxic, and to be feared. In fact, life itself cannot exist without elements. Man, for example, survives by breathing oxygen, whereas plants need the element nitrogen to grow. In other words, elements are the building blocks of the universe. In fact, everything you see or touch, is composed of one or more of 94 elements.

This issue of Tell Me Why helps you explore the absorbing and incredible world of elements.

Is the human body composed of elements?

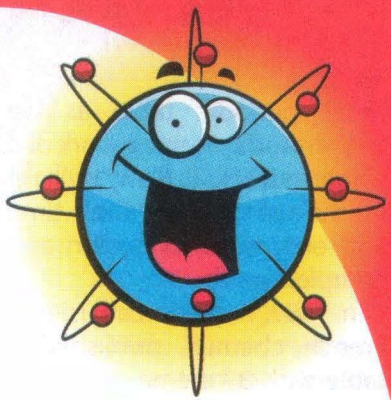
Every part of the human body is made up of elements at the most basic level. So is the case with everything else in the universe.

If we observe the construction of a building, we will see the builder placing one brick over another to raise a wall. Elements to things, are like bricks to a building. They are the fundamental building blocks of matter. We know of 118 kinds of elements today.

What makes one kind of element different from another is the number of protons in its atomic nucleus. Hydrogen has only one proton in its nucleus; whereas, oxygen has 8. These numbers are known as the atomic numbers of these elements.

An element is known by its atomic number and a symbol. The symbol is often an abbreviation of the Latin name of the element. While the symbol of hydrogen is H, the symbol of iron is 'Fe'. This is because iron is 'ferrum' in Latin. Of the 118 elements that we know today, not all elements occur naturally on Earth. Ninety-four of them are natural, while many others can be created artificially.

What are atoms, if everything is composed of elements?



Philosophers in ancient times believed that everything in the universe was composed of extremely small and indivisible units called atoms. But their idea of an atom differed from what modern scientists understand of it today. In fact, elements, the basic building blocks of matter, are composed of tiny particles called atoms.

And what are atoms made up of, in turn? Every atom has a nucleus. It is made up of protons and neutrons and is surrounded by the electron cloud.

Protons possess positive electrical charge and electrons carry negative electrical charge. Neutrons have no electrical charge at all. An atom is usually neutral, as the number of protons and electrons in it is equal. John Dalton, a renowned English scientist, is known for introducing atomic theory into chemistry.

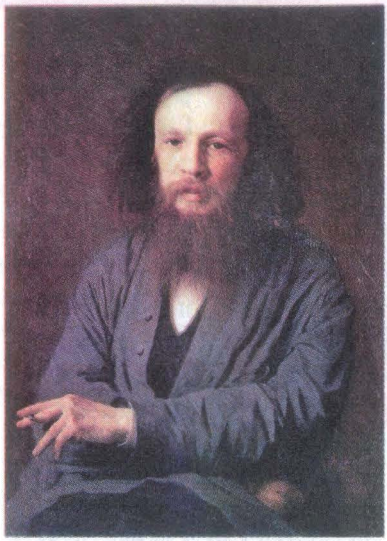
Atoms of the same element are identical. For example, all atoms in oxygen are the same. Atoms of one element can combine with atoms of another element to form new substances. Such new substances are known as chemical compounds. A compound is atoms from diverse elements combined together. Water, sugar, and salt are examples.

Is the periodic table designed by Dmitri Mendeleev?

The periodic table as we know it today is not a work of a single individual. Many brilliant men have devoted their time and energy to its design and completion.

In 1789, Antoine Lavoisier, a French chemist, published a table with 33 elements known at that time. However, the breakthrough came when two distinguished scientists, Dmitri Mendeleev, a Russian chemistry professor, and Julius Lothar Meyer, a German chemist, independently published their periodic tables in 1869 and 1870 respectively. Mendeleev's periodic table gained more popularity than Meyer's, and gradually, his table was recognized and widely used by the scientific community world over.

Mendeleev's achievement has an interesting anecdote associated with it. It is said that the idea of periodic table occurred to him in a dream! He was dreaming about a card game of Patience. Horace Groves Deming is credited for the popular layout of the periodic table we have today.



Dmitri Mendeleev

The periodic table lists and arranges elements in the order of their atomic number. There are rows and columns in it. The vertical column in the table is known as a group, while the horizontal row is called a period. These groups are assigned numbers, and some of these groups have accepted names. For example, elements of group 17 are known as halogens; and number18 is the group of noble gases.

Can hydrogen propel rockets?

You must have seen the launching of rockets on television. Rockets shoot up straight into the sky, and disappear among the clouds in no time. They are so fast. The element used for the propulsion of rockets is hydrogen.

Hydrogen is the most abundant element in the universe. And it is a highly flammable element. When hydrogen comes in contact with oxygen, it produces violent reactions. The explosion generates sufficient energy to propel the rocket upward and break the gravitational pull of the Earth. Besides, the reaction produces an almost invisible flame too.

Hydrogen is a colourless gas. And it is the only element which lacks any neutrons. Let us look at some other characteristics that make this element special!

Hydrogen is the lightest of all elements. It is even lighter than air; and therefore, in its pure form it will easily escape from Earth's gravity into space. Hence, hydrogen present on earth exists in chemical compounds such as water. When extreme pressure is applied to it, hydrogen turns into liquid form. Its atomic number is one and the symbol is H.

Too much is...

In the 19th century, match makers suffered from 'Phossy Jaw' as they were exposed to too much of white phosphorous which ate away their jaw bones.

Which element floats a party balloon?

During festivals or birthday parties, you may have seen balloons that float in the air. If you release their string from your hands, they will slowly rise up in the air and disappear. What makes them float in the air?

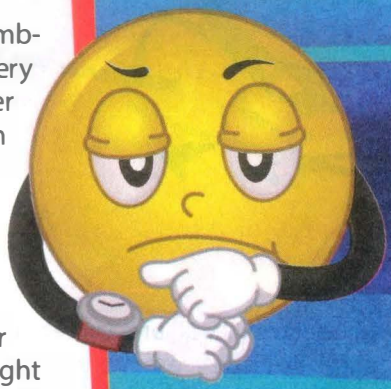
It is the element Helium. Helium is one of the lightest gaseous elements in the periodic table. It is also one of the least dense elements. These qualities make helium an ideal element for lifting things such as weather balloons, or party balloons.

There is something really curious about the discovery of this element. This is the only element which was discovered in space, before its presence was found on earth! It was first detected as an unknown yellow spectral line in sunlight during a solar eclipse in 1868 by Georges Rayet, Captain C. T. Haig, Norman R. Pogson, and Lieutenant John Herschel. It was subsequently confirmed by French astronomer Jules Janssen.

If you have gone scuba diving, helium would have certainly helped you. Helium is used in specialized 'breathing mixtures' of gases for deep-sea diving because it is non-toxic, and can be easily compressed. Its atomic number is two and the symbol is He.

What makes your wristwatch tick?

You may have seen little thumbnail sized, or even smaller battery cells used in watches and other electronic gadgets. We often wonder how such tiny things can power machines. Lithium is the element that gives them power.

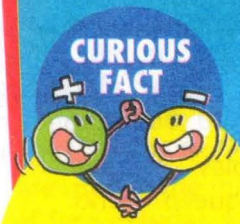


Under standard conditions lithium is the lightest metal; and therefore, this element is ideal for small batteries which must be light and compact for their use in wristwatches, pocket calculators, toys and even cardiac pacemakers. Due to its lightness, it is also very useful in aircraft manufacture.

The speciality of lithium does not end there. It is also a very soft metal. It is so soft that with your kitchen knife you can cut it into pieces. The element is also so low in density that if you drop it in water, it floats!

Scientists believe that the origin of lithium can be traced back to the Big Bang. Lithium must be one of the three elements thought to have come into existence during the Big Bang.

Lithium is abundant in sea water. However, its presence in the soil is very minimal. Lithium is represented as Li, and has the atomic number three.



Helium Fact

Helium takes its name from 'Helios,' the Greek sun god, as it is in the Sun that the element was first discovered.

Is beryllium salts sweet in taste?

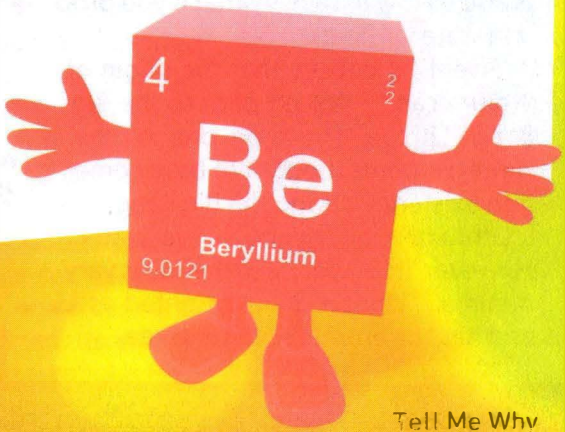
Beryllium salts are sweet in taste. But they are very toxic too. The element beryllium was once known as 'glucine' due to its flavour, and was represented as Gl. In Greek, glucine means sweetness.

Beryllium has been in use for thousands of years. However, in the modern era, it was a scientist called Nicolas Louis Vauquelin who discovered the element for the first time in emeralds in 1798. Two scientists are credited for isolating the metal from beryl and emeralds. Friedrich Wöhler and Antoine Bussy achieved the feat in 1828. And guess what? They did this independently of each other!

Beryllium's presence can be traced in more than 100 minerals. However, extracting the element from them is not an easy task.

Adding beryllium to other metals makes them stronger. When copper is mixed with small amounts of beryllium, beryllium copper is produced. This metal is six times stronger than copper taken alone.

Beryllium appears 4th in the periodic table. Its atomic symbol is Be.



Is boron an element that we come in contact with everyday?

Boron is one element that is found in every household. Whether you want to wash your clothes, or grow some garden plants in your backyard, boron is indispensable. The reason is that boron compounds are used in detergents, insecticides, and fertilizers. Boron is both a common chemical ingredient and an important nutrient for plants.

Boron receives its name from the Arabic word, 'buraq'. It means borax, a mineral from which boron is extracted. Boron has a very high melting point. This quality makes it a suitable ingredient of a host of materials such as pyrex glass and ceramic glazes for tiles and kitchen equipment. Boron makes them resistant to heat.

Boron's household utilities do not end there. Its compounds are used in the manufacture of face powder, as its presence provides a smooth and silky texture and makes the skin look flawless.

Joseph Louis Gay-Lussac, and Louis Jacques Thenard were the scientists who first discovered boron in 1808. Its atomic number is 5, and the symbol is B.

Is diamond a carbon?

Diamond is in fact, a type of carbon. Carbon is capable of forming many allotropes. Well-known forms include diamond and graphite.

Diamond, the hardest substance that Man has ever known, is a solid form of carbon. Graphite is another form of it. It is widely used in the manufacture of batteries, and the brake systems of vehicles. Besides the two there are many other forms of carbon too, such as amorphous carbon, and buckminsterfullerene. A curious fact is, while diamond is the hardest material, graphite is one of the softest known materials in nature.

The presence of carbon is essential to our planet because it is an element that sustains life on Earth. It is a key element to life.

Carbon is the second most abundant element in the human body. The human body contains about 16 kilogrammes of carbon in diverse forms. Carbon comes fourth in abundance when the entire Universe is taken into account.

Carbon boasts of more compounds than most of the other elements in nature-around 10 million compounds in all. Its life is cyclical, as it undergoes a never-ending process of circulating through air, oceans, rocks, plants, and animals.

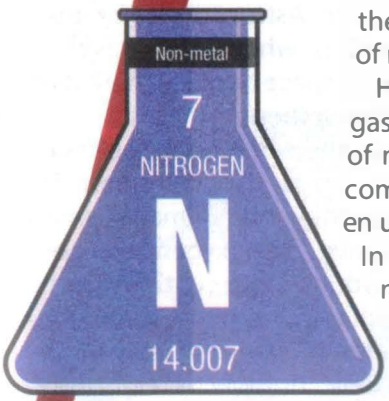
Carbon is an element which

is used in most of the industries in the world. People across the globe use carbon in the form of coal, and crude oil. Black ink for printers and colours for painting are also produced from carbon.

Atomic number of this element is 6, and the symbol is C.

Cool Carbon

Carbon was named so by Antoine Lavoisier in 1789. The Latin, English, French, German, Dutch, and Danish words for carbon all mean the same: "coal"



How abundant is nitrogen in the universe?

A common element in the universe, nitrogen ranks seventh in abundance. Normally, nitrogen is found as an odourless, colourless gas.

This element is found in all living things. About three per cent of the mass of the human body is this element. After oxygen, carbon and hydrogen, three vital constituent elements of the human body, nitrogen is the fourth abundant element in humans.

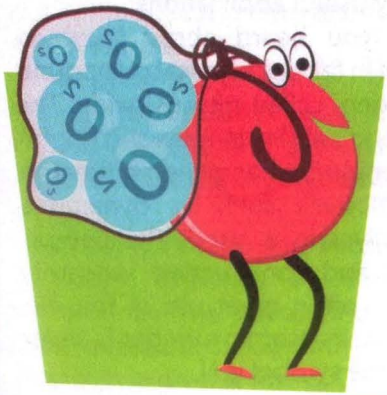
Nitrogen is an important element when it comes to its industrial utility. In food storage facilities and to keep packaged foods fresh, nitrogen gas is used. The element has a major role in the making of certain electronic parts of many useful applications.

Have you heard about laughing gas? It is in fact, a chemical compound of nitrogen, called nitrous oxide. The compound's ability to relax and brighten up people is what gives it this name. In explosives such as dynamites, nitroglycerin is used. The demolition and construction industries have often great use of this element. Its atomic number is seven and the symbol is N.

Which is the element that sustains life on earth?

When it comes to maintaining life on earth, there is no element as important as oxygen. Without this element, we would be dead in no time! Invisible and odourless, it quietly continues to sustain and nourish life in nature. No doubt, oxygen is synonymous with life.

Oxygen makes up one fifth of the earth's atmosphere. It comes third in terms of its abundance by mass in the entire Universe. The reason for its high concentration on the Earth's atmosphere is the oxygen cycle in our planet. It is driven by photosynthesis of plants. The density level of oxygen becomes less, as altitude increases. Mountaineers find it difficult to breathe and have to slowly adjust to the decreasing oxygen levels as they climb higher. Astronauts carry their oxygen when they travel to outer space because there is no oxygen there.



At the same time, too much oxygen is also not good. Do you know that humans cannot survive if the oxygen level goes beyond 25 per cent? The same applies when the level goes below17 per cent as well. Its atomic number is eight, and the symbol is O.

Water Fact

Normally, fresh water contains about 6.04 ml of oxygen per litre, while sea water contains about 4.95 ml of oxygen per litre.

What helps to prevent cavities in your teeth?

Do you know what makes toothpaste manufacturers confidently declare that their product can help you prevent tooth-decay? There is an ingredient in toothpaste that keeps your teeth strong. Fluorine is the element that prevents dental cavities. And fluorine is present in toothpastes in the form of soluble fluoride.

George Gore, an English chemist, is one among the many scientists, who tried to isolate fluorine. However, Gore's experiment ended up in an explosion when the fluorine that he had produced reacted with hydrogen in his lab. Many years later, Ferdinand Frederic Henri Moissan, a French chemist, successfully isolated fluorine in 1886. And his discovery led him to win the Nobel Prize in 1906.

It is very difficult to store fluorine because of its corrosive nature. Fluorine gas quickly attacks most metals, and is highly reactive. And for this reason, fluorine is usually found only in compounds. Due to its exploding tendency, fluorine is maintained in hydrofluoric acid. Atomic number of the element is 9, and the symbol is F.

Which element makes your decorative bulbs glow red?

You must have seen the name boards and advertising signboards on shops glowing in red and orange at night in cities. You must have observed such lights during parties and festivals too. What makes these lights glow in such fashion is a gas called neon.

Neon is widely used in ornamental lighting because when electrical discharge passes through the gas, it produces a red glow. In 1902, Georges Claude, a French inventor and engineer, started producing neon lights commercially.

Neon has no colour or smell. The element gets its name from the Greek word 'neos' meaning 'new'. British chemists William Ramsay and Morris Travers discovered neon in 1898. Neon is the fourth-most abundant element in the Universe, but not on Earth.

Among elements, neon is a recluse. Like a stubborn child, it refuses to form compounds with other elements, or react to any other substance. This is one reason for its scarcity in the air, because natural compounds of neon would have prevented its escape from the Earth's atmosphere.

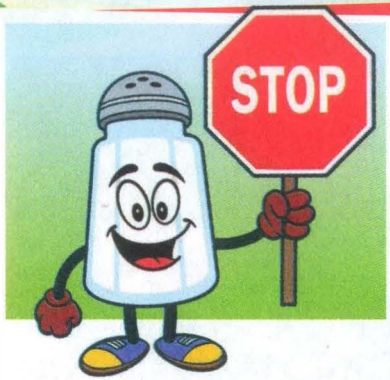
The amount of neon in the air is not so much. Since it is a rare element, it is fairly costly too. Producing liquid neon is about 55 times more expensive than producing liquid helium.

Neon has an atomic number of ten. Its atomic symbol is Ne.

Which sodium compound is an indispensable part of our daily food?

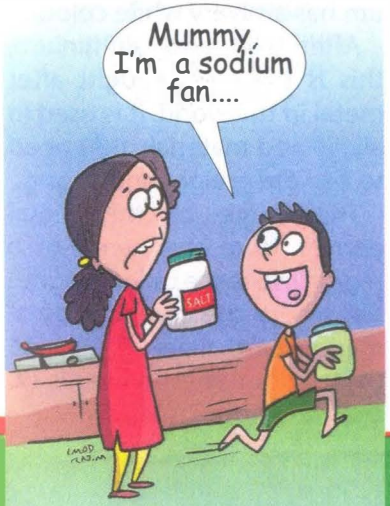
Many sodium compounds are common household items. For example, most of us will find our food tasteless without a substance called sodium chloride. Another sodium compound called sodium bicarbonate is an inevitable ingredient for baking. The former is none other than table salt, and the latter, baking soda.

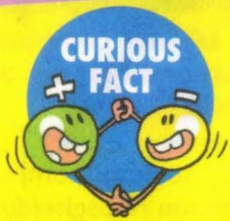
Sodium is the sixth most abundant element in the Earth's crust, and is found in many minerals. It is highly reactive. It is a soft metal; you can easily cut it with a kitchen knife into pieces. The element appears silvery-white in colour.



Sodium has been in use for a very long time, and its compounds have had great historical significance. The element has been used for treating patients, and as a form of currency for thousands of years.

Salt, a sodium compound, has been known to be part of human diet from prehistoric times. People in Ancient Egypt knew the use of a substance called natron which they used to mummify dead bodies. Natron dried out the internal organs, thus preserving it for a long time. This substance is a sodium compound found naturally on Earth. Atomic number of this element is 11, and the symbol is Na.





Ample for a Planet

The total magnesium present on Earth is enough to create a planet of the size of Mars!

Is magnesium found in cabbage?

Magnesium is an important nutrient for humans. Our body absorbs magnesium through leafy vegetables such as cabbage and spinach.

Not just in these vegetables, magnesium is found in all green plants. It is present in their leaves where it traps the Sun's energy to prepare the plant's food. In fact, magnesium is present in the cells of all organisms!

The element is so essential for humans that more than 300 kinds of body processes cannot take place without it. It is plentiful on Earth too, as it is the 8th most abundant element. The element makes up 13 per cent of the Earth's total mass, and it comes third, after sodium and chlorine, in its presence in sea water.

Magnesium is generally found in compound forms. The element mostly combines with oxygen and calcium. Magnesium has a silvery white colour.

After iron and aluminium, this is the most sought after metal in the world. It is used in alloys and materials that need to be light-weight and strong.

The name of the metal derives from the name of a region in Greece called Magnesia, where the compounds of magnesium were found in plenty. Its atomic number is 12, and the symbol is Mg.

Is the precious stone sapphire just aluminium?

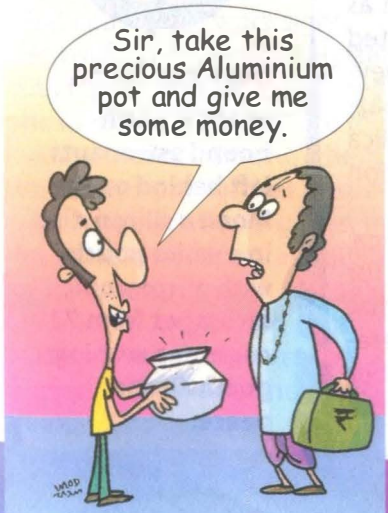
No. Sapphire is not made up of only aluminium. However, aluminium is present in this precious stone. The metal is found in many other precious stones too, such as ruby, topaz, turquoise and jade. However, their amazing colours are due to the presence of other elements.

Aluminium is an element commonly found across the globe. Although Man knew about this element for centuries, only recently did he start using it extensively. Aluminium is a well known conductor of

electricity; and therefore, it is ideal for power cables. Due to its lightness, strength and protective qualities, aluminium is an easy choice for the manufacture of boats, car bodies, and aircraft parts.

Aluminium has some very unique characteristics. It is malleable, meaning it can be shaped into thin sheets. You may have seen thin foils of silver coloured paper for wrapping food items. Aluminium is used for packaging food and drinks. It is tough, yet lightweight, and does not rust. Aluminium reflects heat and light. All these qualities make it an extremely useful element.

Due to its utility, every year, 20 million tonnes of aluminium is produced from its ore worldwide. Its atomic number is 13, and the symbol is Al.



Are silicon compounds easily available in our surroundings?

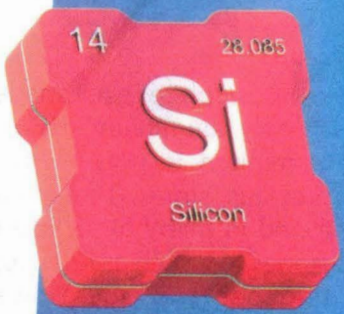
You may have made sand castles on the seashore or a riverbank. If you have, you have come in contact with silicon already.

Silica, an oxide of silicon, is the most common component of sand, which is found everywhere. Since sand and soil make up most of the crust of the Earth, about 27 per cent of it is silicon!

Silicon is widely used for various industrial purposes. Do you use a computer? Computer chips, transistors, and other electronic circuits are made of silicon. Besides computers, silicon is used in cosmetic implants, skin and hair gels, rubber hoses etc.

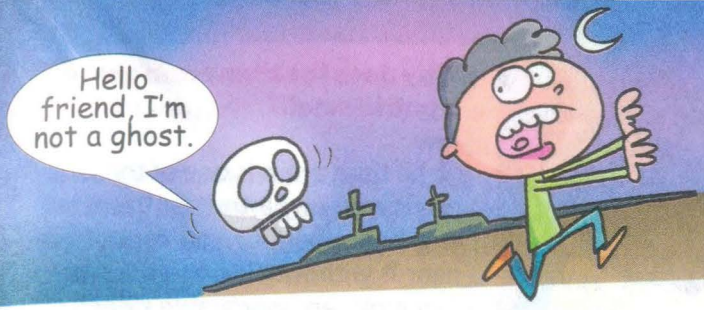
Most of the silicon on Earth is found in the form of silicon oxides such as sand and quartz. Silicon is extracted through a complex process. However, silicon is a prominent health hazard too. Inhalation of fine silica particles can cause a lung condition called 'silicosis'.

Asbestos, a compound of silica, was once a favourite substance for making building. Now, we know that it can lead to lung cancer; and therefore, people avoid it. Atomic number of this element is 14, and the symbol is Si.



Over the Moon

In 1969, Earth-bound astronauts left behind on the Moon a silicon disc in a white pouch with microscopic messages from 73 countries wishing goodwill and peace.



Which is the element that glows in the dark?

People walking by graveyards at night have often reported sighting strange lights there. Many superstitions have originated out of such phenomena in the past. Such visions would certainly frighten people, if they did not know what caused it. White phosphorus deposited on the ground due to the decomposition of bodies is what causes this scary sight.

Phosphorus has many crystal structures. White and red phosphorus structures are the most common among them. White phosphorus has a special characteristic: it glows in the dark. It will spontaneously ignite producing a peculiar glow when it comes in contact with air. And for this reason, it is used in fireworks and explosives.

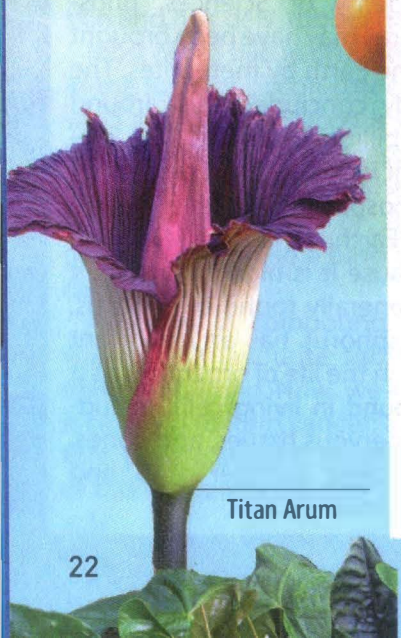
Phosphorus was the thirteenth element to be discovered. Number 13 being considered inauspicious, the element is sometimes called the 'devil's element'. Its glowing nature also adds to it notoriety.

According to a study conducted in 2013 in the journal, Proceedings of the National Academy of Sciences, phosphorus may have been brought to the Earth by meteorites. The study concluded that around 3.5 billion years ago, the element was abundant on Earth.

Phosphorus is never found on Earth as a free element, because it is highly reactive. It is generally found in minerals. Phosphorus has an important role in the life of organisms as it is found in living cells, including nervous tissues, and bones. Its atomic number is 15, and the symbol is P.

Yellow Moon

The presence of sulphur in a variety of states and forms makes Jupiter's moon Io, yellow in colour.



Titan Arum

Why does the titan arum give off a putrid smell?

The titan arum is one of the largest flowers on Earth. It is 10 feet tall and beautiful, but you cannot go near it without closing your nose, as it emits an unbearable stench of rotting fish! The reason for the smell is the presence of sulphur compounds in the flower.

Sulphur was a known substance from ancient times. However, it was Antoine Lavoisier who proved to the scientific community in 1777 that sulphur was indeed an element. It is a very fine, yellow coloured powder, and it stinks when burned in air. The English call this element brimstone.

Volcanic eruptions and emissions through hot water vents in oceans are the main sources for the natural occurrence of sulphur on Earth. Despite its unpleasant smell, sulphur has a vital role in preserving life on Earth. It is a part of proteins, and hence, essential to all living beings. Our skin, hair, and nails get strength from the sulphur bond in the protein called keratin. Penicillin, an antibiotic that kills harmful bacteria, is a sulphur compound. Atomic number of this element is 16, and the symbol is S.

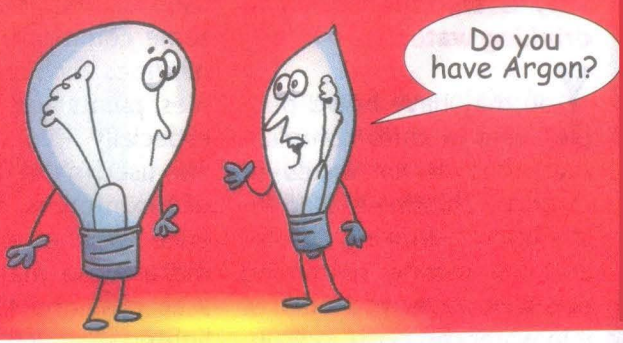
Why is chlorine added in drinking water?

You may have heard people living in cities complain that their water tastes of chlorine. Chlorine is used for sterilizing drinking water and disinfecting swimming pools. However, too much of it in water can cause poisoning.

Chlorine is an element widely used for various purposes. If you have taken a prescription drug, driven a car, or drunk tap water, you are very likely to have been exposed to chlorine. It is used in the production of some commonly used commodities such as paper, textiles, paints and plastic, and especially PVC. Chlorine is also used in the manufacture of car interiors, as the presence of the element can make those materials, from seat cushions to bumpers, lighter.

Man has been using chlorine for thousands of years. Chlorine had been discovered in the 18th century; however, it was not recognized as an element and named until 1810 by Sir Humphry Davy. When chlorine combines with other elements, it is known as chloride. Then, it becomes stable and its toxicity decreases. Sodium chloride, otherwise known as salt, is a common household item.

Chlorine gas was used against the British troops in 1915, during World War I. The gas is dangerously toxic, affecting lungs, and even causing death. Its atomic number is 17, and the symbol is Cl.



What keeps some incandescent lamps from burning out?

Incandescent lamps were quite common before the advent of fluorescent and LED lights. It was a matter of wonder to see the filament of the bulb keep burning for days and weeks without dying out, or blackening the glass. It is an element called argon that does the trick. Argon does not react with the filament used in the light bulbs, even at high temperatures. And that helps the filament last longer, and keeps the glass of the bulb from blackening.

The element is often used in the process of preservation. Important historical documents can be protected from decay with the help of argon. If the gas is pumped around such documents, the element will displace oxygen which is reactive and help the pages and ink of the delicate document from degrading.

Argon is also used for the manufacture of decorative lightings. In the defence industry, the element is considered a blessing, because it is used to cool the heads of heat-seeking missiles.

Argon was discovered and named by Lord Rayleigh, an English scientist, and Sir William Ramsay, a Scottish chemist. Argon has no known biological significance. Large amounts of pure argon in enclosed areas will cause people to suffocate.

Argon is the third most abundant gas on Earth. Its atomic number is 18, and the symbol is Ar.

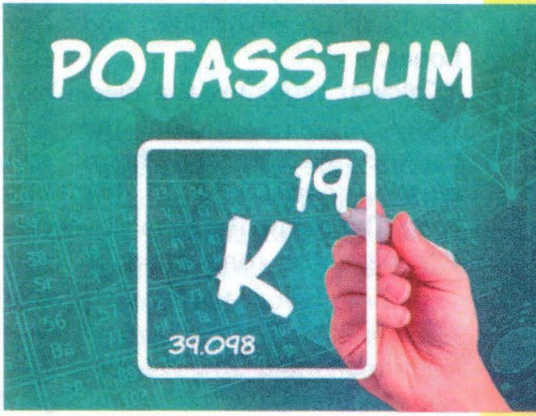
What happens when potassium comes in contact with water?

Water is usually used to put out fire, but if you drop a piece of potassium into water, you will see something incredible!

The element explodes with a purple flame the moment it is exposed to water. Because potassium is a highly reactive metal. It is very sensitive to the oxygen in the air too. Therefore, potassium has to be stored in mineral oil for safety. And for the same reason, the element is rarely seen in its natural form. However, people are familiar with potassium salts such as, saltpeter and potash and they have been in use for centuries.

The fertilizer industry makes great use of potassium, as it is an important nutrient for organisms. It plays a vital role in the human body and is the seventh most abundant element in the human body by weight. Potassium is also used in the production of soap, detergents, dyes, glass, gunpowder, batteries, and even gold. The element derives its name from the word potash.

Potassium is a very soft metal. You can easily slice it into pieces with a knife. It makes up roughly 1.5 per cent by mass of the Earth's crust, and is the seventh most abundant material on Earth.



Potassium was the first elemental metal to be produced through electrolysis. Sir Humphry Davy is the scientist who isolated the element for the first time. Atomic number of potassium is 19. Its atomic symbol is K, which comes from its Latin name, Kalium, which means potash.

Is calcium the most important element in our body?

Imagine humans and animals without bones and teeth! The thing that makes us walk, stand, sit and do anything with our body is this skeletal structure. Calcium is the element essentially necessary for the health of both our teeth and bones.

Calcium regulates the electricity that passes through the nervous system, and helps muscle contractions in the body. This element plays a vital role in causing contractions in the heart. Ninety-nine per cent of the calcium in our body is accommodated in our teeth and bones. It is the most abundant metallic element in the human body. And thus, calcium assumes great importance in our body.

The human race has used calcium for thousands of years. Cornish chemist Sir Humphry Davy successfully isolated this silver-coloured metal for the first time in 1808. Calcium is soft, and is always found combined with other elements in nature. It is found in many rocks such as limestone, chalk, and marble. Calcium is also found in minerals such as gypsum and fluorite.

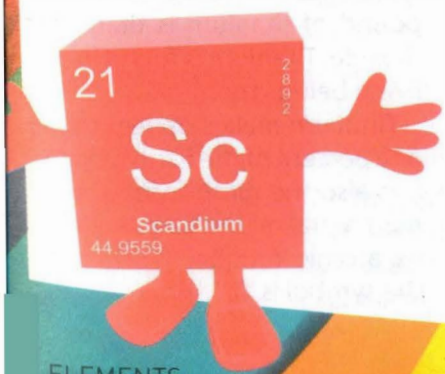
Calcium compounds are used in the manufacture of cement, glass, lime, bricks, and paint, and as a reduction agent in the preparation of other metals.

Its atomic number is 20, and the symbol is Ca.

How did scandium get its name?

Sometimes naming an element is difficult and the discoverer would name it after the place where it was discovered. Our next element is an example. The name scandium comes from the Latin word 'Scandia', which stands for Scandinavia, a region in Northern Europe. The element was named after its first discovery in this region; and not many places outside the Scandinavian Peninsula have deposits of this element.

Scandium is a fairly rare element. It is the 50th most common element in the Earth, and is generally found in small amounts in minerals. The element is very expensive due to its rarity.



Jimmy Neutron

James Chadwick discovered the neutron, and people started calling him Jimmy Neutron!

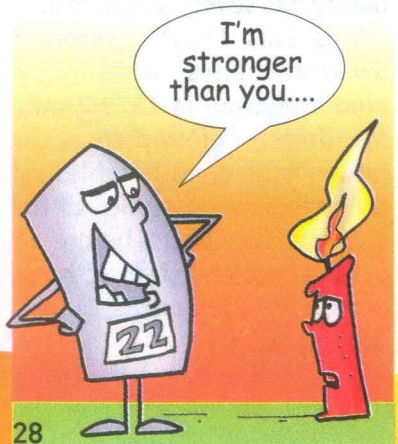
It is a light metal. Scandium is used in baseball bats because the element increases the bat's striking power. It is also used in the manufacture of bright lights. Stadiums, sporting events, and movie production units make use of these lights. However, its cost is a discouraging factor and hence its popularity has severely suffered.

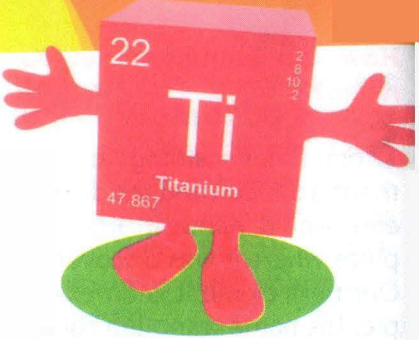
It is Lars Fredrik Nilson, a Swedish chemist, who discovered scandium in 1879. Dmitri Mendeleev, referred to as the father of the periodic table, had predicted the existence of the element ten years before its actual discovery. Atomic number of this element is 21, and the symbol is Sc.

Which element did nations accumulate during the Cold War?

The Cold War period was a time when nations such as the US and the USSR were scrambling for arms and weapons. Both these nations were stockpiling an element called titanium, because they found it extremely useful for military and defence equipment. The strategic importance of the metal made it a much sought after substance.

The element is named after the 'Titans' of Greek mythology. Titans, the mythical divine sons of the sky god Uranus and the Earth goddess Gaia, were strong and powerful rulers.





Titanium is stronger than steel, but much lighter. So, it is widely used for making aircraft engines, ships, and artificial joints. Using titanium plates for supporting fractured bones is prevalent today.

It was named by Martin Heinrich Klaproth, a German chemist, although the element was discovered by William Gregor, a British mineralogist, in 1791. Titanium is present in many minerals. It is generally found in rocks, and most bodies of water. The most common compound of titanium is titanium dioxide. Titanium is found in all living beings too.

Titanium makes up less than one percent of the Earth's crust. It is also the ninth most abundant metal on the Earth's crust. Its atomic number is 22, and the symbol is Ti.

What is the element that adds strength to steel?

You may know that steel, an alloy of iron and carbon, is synonymous with strength. Can it be stronger? Adding various elements to steel will have varying effects on the alloy. Vanadium, a silvery grey metal, increases the hardness of steel.

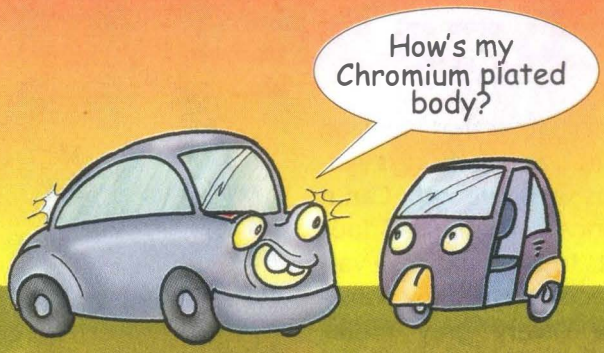
Vanadium is not usually found as a free element in nature. A wide variety of minerals in the Earth's crust contain vanadium. Some minerals containing vanadium are vanadinite, carnotite, and magnetite. The majority of vanadium is procured from magnetite. It is in South Africa, Russia, and China that most of the vanadium is mined.

The majority of vanadium used in industry is as an alloying element to add strength to steel. Vanadium steel is usually used in the manufacture of materials that need to be strong but light-weight, such as automobile parts.

The element was first isolated by Sir Henry E. Roscoe, an English chemist, in 1867. However, the element was given the name by Nils Sefstrom, a Swedish chemist. Vanadium gets its name from the Scandinavian goddess of beauty, 'Vanadis'. Its atomic number is 23, and the symbol is V.

Paint from Egypt

The Ancient Egyptians created the first artificial paints using minerals, such as lapis lazuli, which was crushed to make blue paint.



Is chromium a new element or was it known to the ancient world?

Have you heard of the terracotta army of the Qin dynasty? It is a large collection of terracotta sculptures prepared to be buried along with the Chinese emperor when he died in the 3rd century BC. He would be protected by them in his afterlife, they thought!

Now, what should interest us are not the sculptures themselves, but the presence of an element which the modern world came to know about only in the late 18th century, namely chromium. The weapons of this army were tipped with chromium oxide so that they stayed without rusting for millennia! Chromium was primarily used to produce some highly sought after pigments of red and yellow.

The precious ruby stone gets its natural red colour from chromium. Chromium has a silvery, shiny appearance, and is a favourite substance to coat cars, and other appliances to protect them from corrosion and to improve their looks.

Chromium is generally found in its ores. It is rarely found in its pure form in nature. The most common ore from which chromium is extracted is chromite. Some forms of chromium are non-toxic. However, chromium (VI) is carcinogenic. The discoverer of chromium is Nicolas L. Vauquelin, who achieved the feat in 1797.

Its atomic number is 24 and the atomic symbol is Cr.

Why is manganese a unique element?

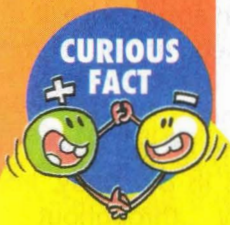
The name of the element manganese, comes from the Latin word, 'magnes', which means magnet. However, do not think that manganese is magnetic as its name suggests. The name, in fact, derives from its compounds, which are used in the manufacture of glass.

Manganese has been in use from ancient times. Researchers have found pigments of manganese in cave paintings dating from the Stone Age. Many alloys of manganese are in use today, especially in the manufacture of steel and glass.

The element is mostly found in the Earth's crust. However, it is very hard to discover it as a free element in nature, as it is often found in minerals that contain iron. It is the 12th most abundant element on earth's crust and most of the world's manganese is found in South Africa and Australia. Deposits of manganese are also found on the ocean bed.

Manganese in it pure form is a reactive element. It burns in the presence of oxygen, and rusts when it comes in contact with water. It is silvery white in colour, and looks like iron.

Manganese is an important nutrient for humans and animals, as it helps metabolic functions. Its atomic number is 25, and the symbol is Mn.



Call of Death

The early death of Mozart at the age of 35 is believed to have been caused by the antimony compound prescribed by his doctor to treat his depression.

Are we living on an enormous lump of iron?

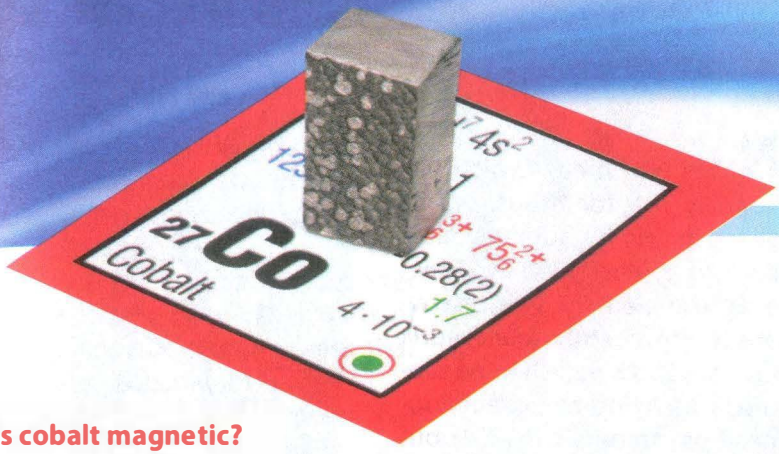
Yes, we are living on a huge mass of iron, the Earth! In fact, the centre of the Earth is almost all iron. The surface of the earth is also rich in this element. Due to its abundance, the metal is used widely for a host of utilities. From steel in the hulls of ships, and cast iron in pipes, to stainless steel in cutlery and wrought iron in gates, this element is the main ingredient contained in most objects you see and use every day.

Iron is a heavy metal. At the same time, it is pliable too. Grayish in appearance, it is the most used of all elements, because it is extremely hard and strong.

It is one of the most useful elements in our body. Iron is necessary throughout our body, and is especially essential to our blood. Through blood vessels, iron atoms carry oxygen from lungs to our heart and brain. They also take carbon dioxide back to our lungs to be blown out. Iron is stored in our blood cells, liver and other tissues. Its atomic number is 26, and the symbol is Fe.

Too Expensive

Humans have found a use for most elements, except one: lutetium. Do you know why? Lutetium is the most expensive metal in the world!



Is cobalt magnetic?

A magnet attracts or repels other metals. Cobalt is magnetic; in fact, it is one of a handful of elements which are naturally magnetic. Cobalt maintains its magnetism, even at high temperatures.

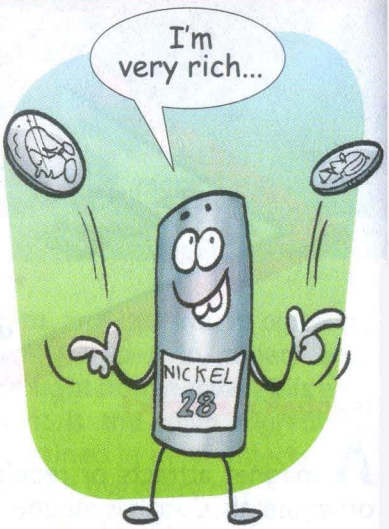
Cobalt resembles iron and nickel. In its pure form, it has a silvery blue colour. It is a brittle metal. It is generally found on Earth in its chemically combined forms.

Georg Brandt, a Swedish chemist is recognized for isolating cobalt in 1735. However, even before its formal discovery, the metal has been in use throughout history. Pigments of cobalt, especially cobalt blue, have been used by painters for thousands of years. Researchers say that the use of cobalt as a colouring agent dates back to as far back as the Bronze Age.

The ancient Egyptians made use of this element in their art and jewellery. The discovery of the metal in the ruins of Pompeii, an ancient city of Rome, has great archaeological significance too. Cobalt is also used in the medical field. A man-made isotope of the element, Cobalt-60 is commonly used in cancer treatments.

Its atomic number is 27, and the symbol is Co.

Which is the fifth most abundant element on Earth?



Nickel is a metal which has been in use for thousands of years. Its use by humans dates back to at least 3500 BC. However, the element was discovered quite recently. Axel Fredrik Cronstedt, a Swedish mineralogist, was trying to extract copper from minerals in1751; but succeeded in discovering another metal, which he named nickel.

Nickel is the sixth most abundant element on Earth. However, its presence in the Earth's crust is very minimal. The element is 100 per cent more concentrated below the Earth's surface than in the crust.

Under standard conditions, nickel is found to be silvery white in colour and is fairly hard. This element is magnetic at room temperature like three other metals, such as iron, cobalt, and gadolinium. However, nickel loses its magnetism above 255 degrees Celsius.

Most of the metal obtained today is used in the manufacture of nickel steel and alloys. Nickel steel, such as stainless steel, is an extremely strong material. The element is useful for a host of other products such as batteries, coins, guitar strings, and armour plates.

Nickel is generally identified in meteorites where it is usually found combined with iron. There is a large nickel deposit located in Canada, and scientists think it is from a meteorite that smashed into the Earth thousands of years ago. Atomic number of this element is 28, and the symbol is Ni.

How did the element of copper get its name?

In ancient times, the metal copper was found in abundance on Cypress, an island country in the Mediterranean.

The country was a major exporter of the metal to the other parts of the world. It is from Cypress that copper gets its name.

Copper was the first metal that man attempted to shape and mould. One of the greatest discoveries of the ancient man was the knowledge that a harder alloy metal, bronze, could be produced by adding tin to copper. This discovery led the human race to the Bronze Age.

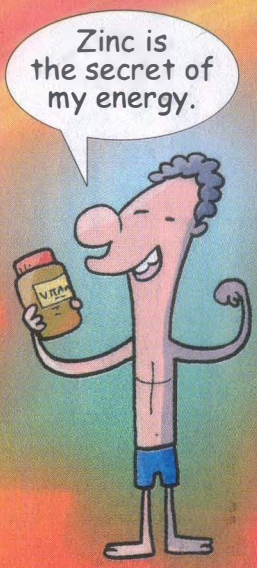
Besides gold, copper is the only metal in the periodic table whose colouring is not naturally silver or grey. Shiny and reddish, copper was the first metal that man learned to manipulate, and it remains one of the most important metals in the world today.

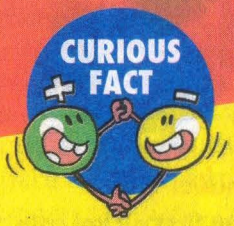
Copper is one of the few metals that occur in nature in their directly useable form. A key metal in industry, copper is used for electrical wiring, plumbing and roofing.

The atomic number of copper is 29, and the atomic symbol is Cu.

Nickel Coin

The first nickel coin was the American one-cent piece 'flying eagle', piece, with 12 per cent nickel and the rest, copper. The coin, the first to be named a 'nickel', was in circulation for only two years, between 1857 and 1858.





Zinc in India

Zinc was in use in India thousands of years before its use in China. While the Chinese started its use only in 1637, the metal was mined and smelted in the Indian subcontinent in the 9th century BC.

Which element when alloyed with copper is called brass?

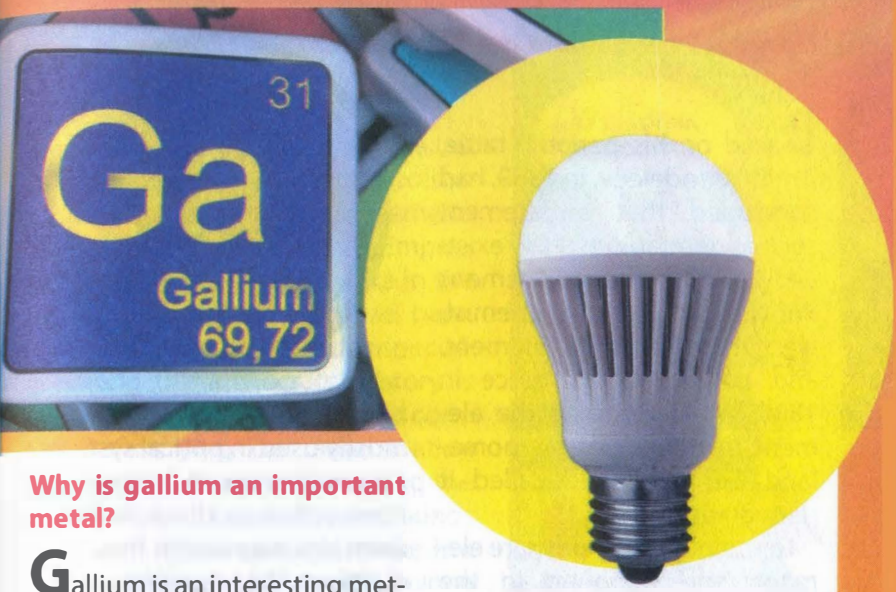
Zinc, like copper, is a metal which was in use from ancient times. This bluish-silver coloured metal is crucial to life today as it is important in many industrial processes that often go unseen. Zinc is mostly used as an anti-corrosion agent.

The element was probably named by the 16th century Swiss physician and alchemist Paracelsus. Zinc is used in the production of brass alloying with copper. There are many other alloys of the metal too. Zinc has non-corrosive properties; and therefore, it is used in plating iron.

After copper, iron and aluminium, zinc is the most required metal in industry. It is zinc that is used in lithium batteries as anode. It is used in paints, fire safety equipment, wood preservatives, clocks, farming etc.

The element, in its pure form, was discovered by Andreas Sigismund Marggraf, a German chemist, in 1746. Zinc is the 25th most abundant element in the earth's crust.

The element burns with a blue-green flare. Thirty per cent of the production of zinc is done through recycling and the rest by mining. It has an atomic number of 30, and the symbol is Zn.



Why is gallium an important metal?

Gallium is an interesting metal because it is hard and brittle in a cool atmosphere, soft in standard temperature and liquid in warm conditions. This metal is never found in its free form in nature.

Dmitri Mendeleev, whom we have seen before as an illustrious scientist and the father of the periodic table, had predicted the existence of gallium before its discovery. He had named the missing element as 'Eka-Aluminium'.

The element was first discovered in 1875 by Paul Emile Lecoq de Boisbaudran, a French chemist.

You may have wondered how LED lights emit such glow. Gallium is used in the Light Emitting Diodes (LED). It is also used in electronic circuits and as semiconductors.

The element has use in high-temperature thermometers, barometers, pharmaceuticals etc. However, the element has no known biological value.

Gallium makes up about 0.0019 per cent of the earth's crust by weight. The largest producers of gallium are Australia, Russia, France and Germany. It has an atomic number of 31, and the symbol is Ga.

How does germanium get its name?

Based on his periodic table, Dmitri Mendeleev, in 1869, had concluded that an element such as germanium really existed. It was, however, Clemens Winkler, a German chemist, who first isolated the element, and proved its existence in 1886. Winkler named the element in honour of his homeland Germany, and called it germanium.

Germanium is a fairly rare element, and is found in the earth's crust. It is shiny and silvery in its appearance. It is very hard and brittle. Although there are some minerals that contain a fair amount of germanium like germanite and argyrodite, they are too rare to be mined.

The element is not a nutrient for organisms in nature. Therefore, its presence in the earth has no significance to plants and animals. However, sometimes germanium is used in medicines.

Germanium is an important component in semiconductors and fibre optics. Germanium is mostly used in optical systems. Applications such as cameras, fibre optics, and microscopes need this element in their production. The element is also used in infrared optics. It is one of the few elements that expand and turn solid when they are frozen. The atomic number of germanium is 32, and the symbol is Ge.

Why is arsenic a notorious element?

Do you know that arsenic is called the 'king of poisons' and the 'poison of kings'? It is a very toxic element. From the time of the Roman Empire, all the way to the Victorian era in the 19th century, the element had been used for murder and suicide especially among the aristocrats. History is full of stories of both royalty and commoners carrying out assassination attempts for personal gain using the odourless and tasteless compounds of arsenic. These qualities make it a perfect poison, which can kill anyone quickly if taken too much.

However, despite its reputation as a lethal substance, arsenic still holds a very important place in the natural world. The element has been used in the medical field for centuries.

Arsenic is combined with gallium to produce gallium arsenide for use in high speed electronics and optoelectronics. Other applications for arsenic include metal alloys and glass making.

Arsenic has many allotropes. Allotropes are different structures of the same element. Arsenic was first isolated by Albertus Magnus in 1250. The atomic number of the element is 33, and the atomic symbol is As.

STAR FACT

On Jupiter

Germanium has been found in the atmosphere of Jupiter and in distant stars.

The Discoverer

Selenium was discovered in 1817 by the Swedish chemist Jöns Jacob Berzelius.

Is selenium essential for humans?

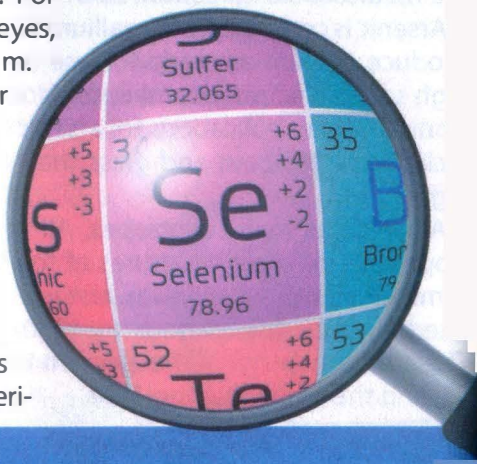
It is unlikely that you have heard about an element called selenium. However, it is essential for the human body.

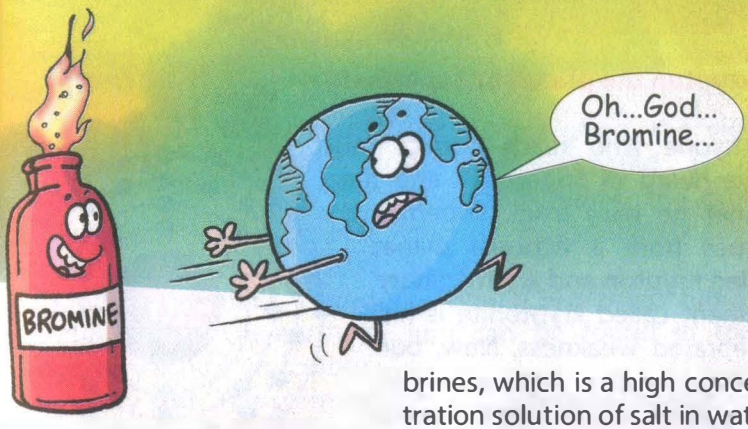
The element has the ability to block the effects of toxic metals such as arsenic, thallium, and the mercury found in fish. It is also a micronutrient in animals.

It also plays an important role in the production of several vital enzymes in humans. For healthy joints, heart and eyes, humans need selenium. While it is essential in our body, too much selenium in the diet can be toxic as well.

Selenium is not a metal, although it may look like one. It is solid in room temperature. Primarily, the element exists in two forms: as solid material in silver colour and powdery form in red colour. The element is a good conductor of electricity. Therefore, it is used in photoelectric cells, photocopiers, solar cells, and semiconductors.

While Germany is the country that produces selenium the most each year, China is the biggest consumer of the element for industrial purposes. The atomic number of selenium is 34, and the atomic symbol is Se.





Which is the element that burns your skin?

Bromine is a slightly toxic element and in its liquid form can burn your skin.

This element is a deep red, oily liquid at room temperature. However, it can quickly evaporate into a gas with the same colour. Bromine has a strong and unpleasant smell too. This element is the only non-metal to exist in liquid form at room temperature.

Bromide salts were once a favoured material as flame retardants and sedatives. However, the toxicity of the compound has discouraged people from using it.

The element is extracted from sea water and natural brines, which is a high concentration solution of salt in water. Bromine is used in the production of fuels, insecticides, fire extinguishers and pharmaceuticals.

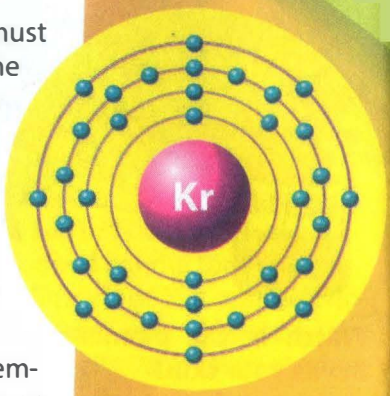
The mineral deposits of bromine in the US are found in the natural brine wells of Michigan and Arkansas. Israel, Russia, France and Japan are also countries that produce bromine industrially. Worldwide, the production of bromine is estimated to be around 330,000 tonnes per year.

Bromine is a harmful element to the atmosphere when exposed in the open. It actively contributes to the depletion of the ozone layer, and lets in the hazardous rays of the sun.

It is the 59th most common element in the earth's crust. Bromine has the atomic number 35, and is represented as Br.

Is krypton the planet of Superman?

Anyone who reads comics must have heard of Superman, and the planet he hails from. Superman comes from a fictional planet called Krypton and an imaginary element called kryptonite is his celebrated weakness. Now, our element krypton has nothing to do with either of them. It is one of the rarest gases on Earth.



Sir William Ramsay, a Scottish chemist, and his student Morris Travers, an English scientist, discovered krypton in 1898. The element has neither colour nor smell. It does not react with any element other than fluorine gas.

A type of krypton has a line in its atomic spectrum, and it was used as the standard measure of length from 1960. One metre was defined as exactly 1,650,763.73 wavelengths of this line. This continued to be the standard of measurement for 23 years. But, now the definition has changed.

Since the element is rare, and expensive, its utility is very limited. The gas is often used in incandescent lamps. It extends the life of the tungsten filament that glows in the bulb when the gas is injected into the lamps. The atomic number of krypton is 36, and the symbol is Kr.

Non-toxic Killer

Krypton is believed to be a non-toxic asphyxia-inducing agent because it displaces breathable air.

What are the features of the element rubidium?

Rubidium is a metal which is the 23rd most abundant element found in the crust of the earth. It is silvery-white in colour, and very soft. The element is highly reactive and reacts quickly with air. In nature, there are several minerals which contain up to one per cent of the oxide of rubidium.

Although rubidium is not a rare metal, it does not have a lot of industrial or commercial uses. Therefore mining of rubidium is fairly limited. It is used mainly for powering atomic clocks in global navigation satellite systems. Sometimes, rubidium is also used in the production of purple colour in fireworks. However, it is mostly used for research.

Rubidium was discovered by the German chemists Gustav Robert Kirchhoff and Robert Wilhelm Bunsen in 1861. Most often, the element is extracted as a byproduct during the production of potassium or caesium.

About 0.36 grams of rubidium can be found in the body of an average-sized human. The human body treats rubidium as though it were potassium, so it is most often found within the cellular fluid. Rubidium does not serve a vital purpose in animals and plants.

The atomic number of rubidium is 37, and the symbol is Rb.

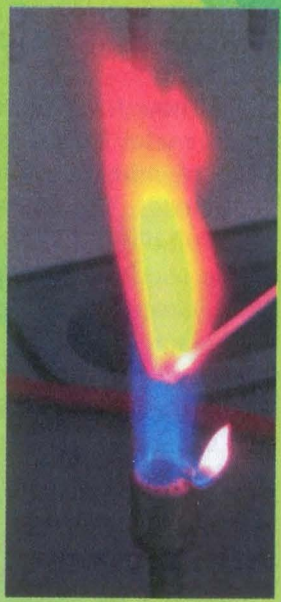
How did strontium get its name?

Strontian is the name of a village in Scotland. The mineral containing strontium was first discovered in this village, and the element is named after the village.

Strontium is a soft, silver-coloured metal. The element has several uses. Strontium blocks X-rays emitted by TV picture tubes. The element is used in paints that glow in the dark. In fireworks, certain brilliant red hues are produced with the help of strontium. It also plays an important role in tracing the origins of species.

Many scientists have richly contributed to the discovery of strontium. However, it was Humphry Davy who isolated the element for the first time. He achieved the feat in 1808 by means of electrolysis.

Strontium is the 16th most abundant element in the earth's crust. It is said that German sugar industry used up to 150,000 tonnes of strontium per year leading up to World War I. Today China is the leading producer of strontium while other countries like Spain, Argentina and Mexico present a stiff competition to the topper. Strontium has the atomic number 38, and it is represented as Sr.



Flame test for Strontium

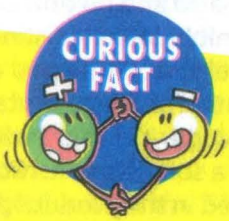
What makes the elements Yttrium and Zirconium special?

In 1789, a Swedish chemist called Carl Axel Arrhenius made a curious discovery in a quarry of a village called Ytterby. It was a piece of odd-looking black rock. The rock piece contained four elements and one of them was yttrium, named after the village. The village became the namesake of the other elements found in the rock as well, such as, erbium, terbium and ytterbium.

Yttrium is a soft metal. Yttrium in its pure form is stable in the air when it is a large piece. Whenever yttrium is sliced into little shavings or small particles, it starts to become reactive and thus unstable. About 31 parts-per-million of the earth's crust is yttrium, and that makes it the 30th most common element. The atomic number of Yttrium is 39, and it is represented as Y.

The element zirconium is greyish white in colour. In powder form, zirconium is highly flammable. It is not generally found in nature in its metallic form due to the way the element reacts with water. Moon rock samples retrieved by NASA's Apollo missions found the presence of zirconium in lunar rock.

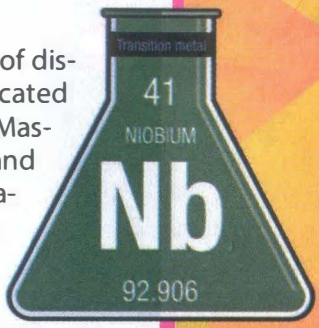
Zirconium has the atomic number 40, and it is represented as Zr.



Sweet Element

Strontium is used in the production of sugar from sugar beet. Most of the strontium used in the process of making sugar is recyclable.

How was niobium discovered?



Niobium has an interesting account of discovery. John Winthrop, an American, located a piece of mineral called columbite in Massachusetts in 1734, and sent it to England for examination. The mineral was analyzed in 1801 by Charles Hatchett, an English chemist. He discovered a new element in the mineral and named it columbium after Columbia, a historical, poetic name that refers to the United States of America.

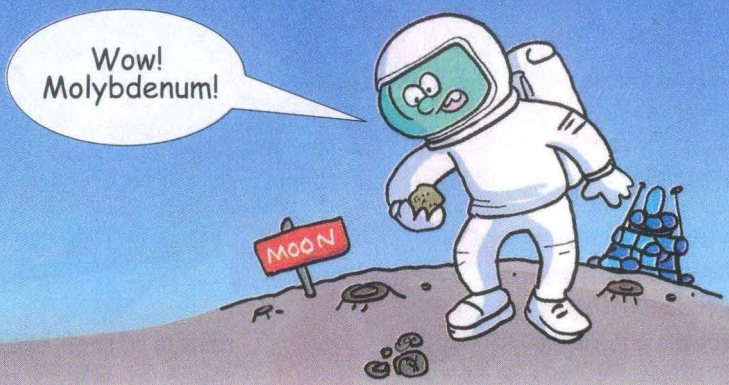
William Hyde Wollaston, an English chemist, compared columbite with another mineral, tantalite, and declared that columbium was in fact the element called tantalum. In 1844, Heinrich Rose, a German chemist, working with samples of columbite and tantalite, produced two new separate, but very similar, acids, which he named niobic acid and pelopic acid. Later, he recognized niobium as a distinct element.

The element is named after Niobe, the daughter of king Tantalus of Greek Mythology. It is shiny-white in colour, and is a soft element. Niobium alloys are used in the production of highly-specialised steel that is used in the manufacture of stronger gas pipelines. Niobium alloys are also used in rocket and jet engines due to their superior strength at extremely high temperatures.

It has the atomic number 41, and it is represented as Nb.

Changing Metal

Of the 32 known radioactive isotopes of niobium, the most stable one is reduced to half its initial value in 34.7 million years.



What are the characteristics of molybdenum?

Molybdenum disulphide, also known as molybdenite is a black, soft mineral which was often mistaken for graphite or lead ore until 1778. Carl Scheele, a German chemist, analyzed the mineral and revealed that it was neither of these substances, and was in fact, a totally new element.

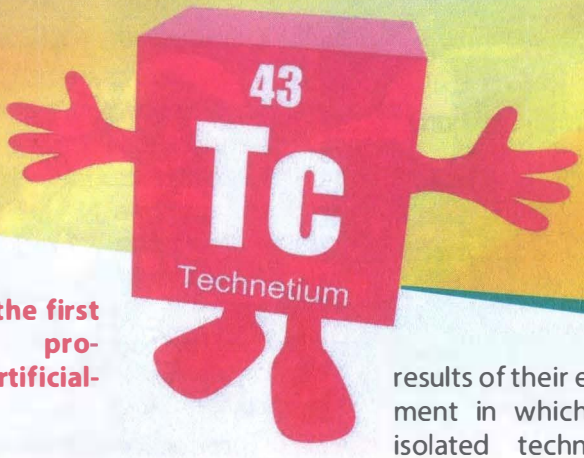
Molybdenum plays an important role in living organisms. The element is vital for the enzymes in bacteria to undergo nitrogen fixation.

There are approximately fifty molybdenum-containing enzymes, which are found in both bacteria and animals. Molybdenum is used in the production of many alloys due to its ability to withstand extreme temperatures. Therefore, it is used in the manufacture of military armour, aircraft parts, electrical contacts, industrial motors, and filaments.

The element is recovered as a by-product of copper or tungsten mining. Molybdenum is not a naturally occurring element; however, it is found in its different states within other minerals.

Molybdenum is the 54th most commonly occurring element in the earth's oceans. Russia's Luna 24 space mission discovered samples of molybdenum on the moon too.

The atomic number of Molybdenum is 42, and the atomic symbol is Mo.



Which is the first element produced artificially?

Dmitri Mendeleev had predicted in 1871 that an unnamed element with an atomic number 43 would possibly be present in the universe. He thought it would have properties very close to manganese, and even named it eka-manganese. Nearly seventy years later the element technetium with the atomic number 43, was discovered in a laboratory.

Many scientists had published reports that they had discovered Mendeleev's predicted element 43 in 1846, 1847, 1877, 1896, 1908, and 1925. None of these turned out to be technetium, as they all were other elements.

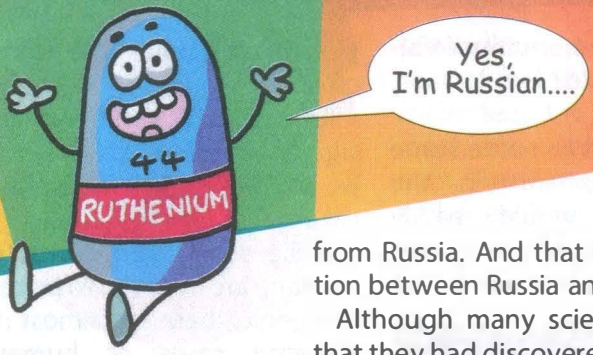
In 1937, Emilio Segre and Carlo Perrier published the results of their experiment in which they isolated technetium from a sample of molybdenum.

Technetium was the first element to be produced artificially. All the original technetium present when Earth was formed, has long since decayed.

Almost the entire element that is produced today, is produced artificially. It is so rare an element that only around 18000 tonnes of it could be found in the earth's crust.

Today, technetium is used in radioactive isotope medical tests. Highly radioactive, it is also used in a host of diagnostic tests. It has several other industrial and chemical uses too.

The atomic symbol of Technetium is Tc.



Do ruthenium and Russia have anything in common?

The first impure form of ruthenium was discovered in Russia. In the Latin language, Russia is known as Ruthenia. Therefore, the element ruthenium gets its name from Russia. And that is the connection between Russia and ruthenium.

Karl Ernst Klaus

Although many scientists claimed that they had discovered the element in the first half of the 19th century, it was Karl Ernst Klaus, a Russian chemist, who successfully isolated the element in 1844.

The Native Americans knew the use of the metal many years before its discovery. Ruthenium is the seventy-third most common metal on Earth. It is an extremely rare metal in nature. Due to its scarcity, only around twenty tonnes of ruthenium is produced annually.

Pentlandite is the mineral from which most of the ruthenium is mined. Adding ruthenium is one of the most effective ways to harden platinum and palladium. Ruthenium can also be extracted from nuclear waste such as uranium-235.

Ruthenium is used most commonly for creating a coating over electrical contacts for wear-resistance. Ruthenium's atomic number is 44, and it is represented as Ru.

Is there an element more valuable than gold?

When asked to name some expensive elements in the world, many would readily name gold and silver. However, there are many other precious

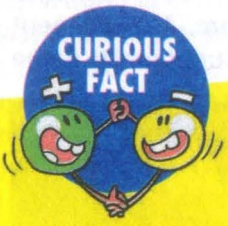
elements in the world. Rhodium is one among them. It is a silver-white element. It is costlier than gold or silver.

Rhodium was discovered in 1803 by William Hyde Wollaston, an English chemist. He had just discovered the element palladium in the previous year. Rhodium derives its name from the Greek word 'rhodon,' meaning rose, named for the rose-red colour of its salts. It is one of the rarest elements, ranging up to only .00002 parts per million (ppm) in the earth's crust.

Rhodium does not play any significant role in life processes, and has no known biological use.

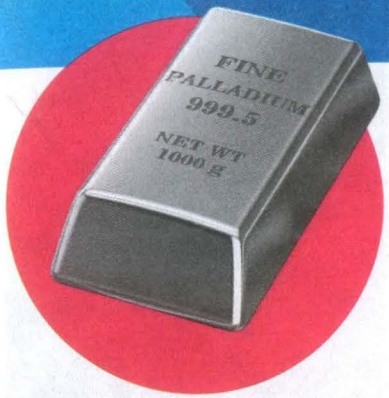
While some compounds of rhodium are believed to be carcinogenic, there are almost no reported cases of humans being affected by this element in any way. This may be due to the fact that we rarely come in contact with rhodium compounds in everyday life.

The atomic number of rhodium is 45 and it is represented as Rh.



Unsafe

Palladium is relatively biologically inactive, but can cause allergic reactions in some people. If you have a nickel allergy, you're at a higher risk of irritation from palladium.



How does white gold get its white colour?

Have you seen any ornament made of white gold? White gold jewellery is supposed to be more expensive than regular gold ornaments because of the presence of an expensive element called palladium. Shiny and silvery, the element palladium is what gives white gold its colour.

Palladium is a crucial component of fuel cells and catalytic converters. It is a very rare element, rarer than gold or platinum. The element is malleable and doesn't tarnish in air, as it does not react with oxygen. These qualities make it a popular metal for jewellery. Hydrogen gas can filter through it, so palladium is used to remove hydrocarbons from fuels.

Palladium was discovered in 1803. The metal was first isolated by William Hyde Wollaston, an English chemist. Palladium gets its name from the asteroid 2 Pallas, the second-largest asteroid in the asteroid belt, which had just been discovered in 1802. The asteroid itself was named after the ancient Greek goddess Pallas Athena.

Palladium is found only in rare minerals. The only palladium mine in the United States is the Stillwater Mine in Montana; other mines are in Canada, South Africa and Russia. Russia is the world's largest palladium producer.

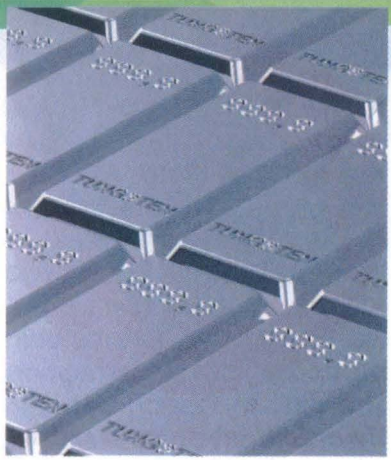
The atomic number of palladium is 46, and its atomic symbol is Pd.

What makes silver special?

Silver, like gold, is a popular metal for making ornaments. It is a beautifully shiny metal, but it has often had to play second fiddle to gold.

Silver was known to prehistoric humans. People of ancient civilizations as early as 3000 BC, knew how to separate silver from lead. In the past, silver was extracted from other minerals through an interesting method.

The metal was placed in a shallow cup called a cupel and heated under a strong gust of air. This process removed the other metals, leaving small round drops of liquid silver.



Silver has been the most favourite metal for making coins and jewellery from the beginning of civilizations. It is used in the production of adornments, mirrors and photo-optics, musical instruments, dentistry and medications, photography, and many more. Nowadays the element has been used in wound-dressings as it has the ability to destroy many bacteria and viruses.

Silver is generally found in copper or lead ores and the element is extracted from these minerals. Since the 1500s, several countries have been mining silver. Mexico is the world leader in silver mining and is followed by Peru.

Agatha's Poison

The murderer's poison in the novel *The Pale Horse* by the mystery writer Agatha Christie, who was once a pharmacist, was thallium. The first clue of its toxicity was the hair loss in the victims.

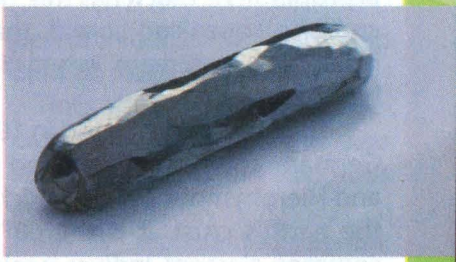
Silver is sensitive to light, so silver compounds are coated onto the film of x-rays and photographic prints to make the images. Silver has the atomic number of 47, and it is represented as Ag which stands for 'Argentum' which is the Latin word for the metal.

What are the characteristics of cadmium?

Cadmium is a soft metal, bluish silvery-white in colour. In 1817, Friedrich Stromeyer, a German chemist, discovered cadmium after isolating it from zinc carbonate. Another German, Karl Samuel Leberecht Hermann, had also discovered the element in the same year. The name comes from the Latin word 'cadmia', the name for the calamine ore.

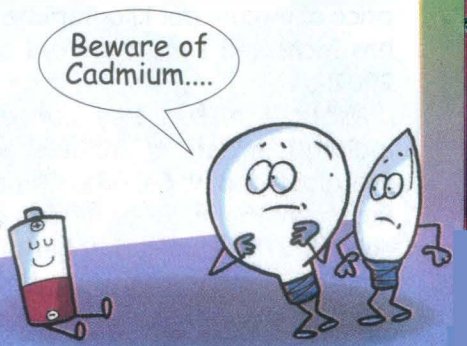
In bulk, cadmium is non-flammable, but will burn and release poisonous fumes when in a powder form. Earlier, cadmium was used in the manufacture of paints and screws but now it is not used for those purposes as the element is found to be toxic.

Cadmium is naturally resistant to corrosion; and therefore, it is often used as a protective coating on metals. Cadmium electroplating is especially common for aircraft. The element plays a key role in the production of rechargeable batteries, specifically nickel-



cadmium batteries. It also plays a significant role in nuclear energy, as cadmium serves as both a barrier and as an alloy for pressurized water reactors.

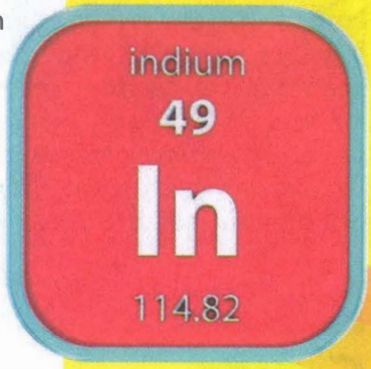
The atomic number of cadmium is 48, and its atomic symbol is Cd.



How did indium get its name?

The name of the element indium comes from the bright indigo coloured line in its spectrum.

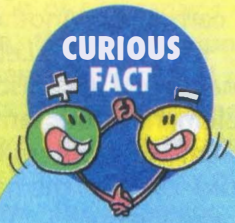
Have you heard of metals that let out loud cries? They certainly do not cry as humans or animals do. One of indium's most unusual properties is that it has this 'tin cry' or a squeaking sound, that resembles a scream when it's bent.



Indium was first isolated in 1863 by German chemists Ferdinand Reich and Hieronymous Theodor Richter. In the earth's crust, it is the 68th most common element. Indium is relatively rare in the earth, and is typically found in zinc ores. It's also found in some lead, copper and iron ores.

Indium is indispensable in the manufacture of LCD monitors, televisions and display screens; and therefore, its demand has increased greatly over the years. Due to this demand, the price of indium per kilogramme also has increased almost tenfold since 2002.

About 4 million troy ounces of indium is produced annually across the globe today. Canada, China and Russia are the major producers of the element. The atomic number of indium is 49, and the atomic symbol is In.



Fantastic Four

Hydrogen, carbon, nitrogen and oxygen make up more than 95 per cent by weight of all living things on Earth.

Is tin one of the oldest metals known to man?

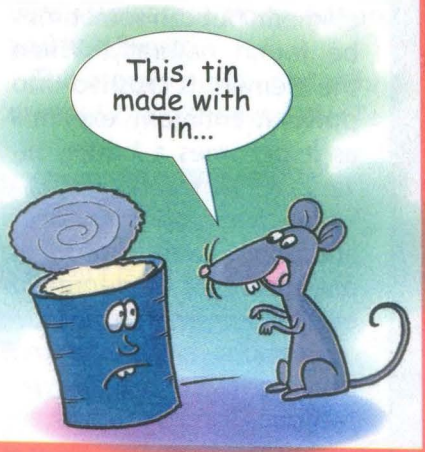
Tin is perhaps one of the oldest metals known to Man. Tin was familiar to Man in ancient times as he learned to add it to copper to make bronze, thus setting off the Bronze Age.

Tin is an element perhaps best known for its use in tin cans. However, these days, such cans are almost always made of aluminium. Even the original tin cans, first introduced in the 1800s, were mostly steel, but plated with tin!

Tin is the 49th most common element in the earth's crust. Today, tin is used as a coating for steel to make tinplate. Tin is added to lead for soldering metals also. Tin added to silver and copper is used for dental amalgams. It is a component of pewter, metals for bells, and Babbitt metal in bearings.

Tin is also used in art and decorations. The element is also important in Li-ion batteries and PVC plastics.

Tin is represented as Sn, which comes from the Latin word stannum. Stannum was known to be an alloy of lead and silver. The atomic number of tin is 50.



Was antimony known to man in the Middle Ages?

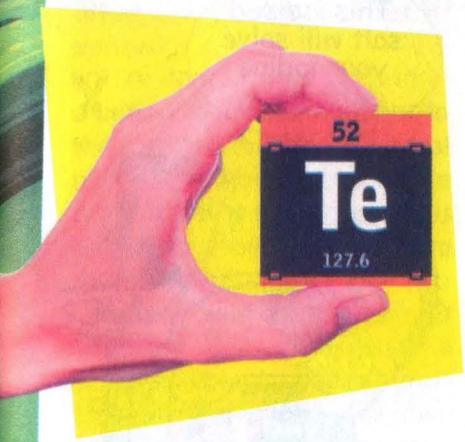
The ancient world was familiar with the element antimony. An unknown alchemist had identified the element in the Middle Ages. Antimony is named after the Greek word 'stibium', which was the name of its compound known in the ancient times. Some say that antimony literally means 'monk-killer' as most early chemists were monks and the element was a notorious toxin that killed many who experimented with it.

Antimony is a silvery, lustrous grey metal. It is a rare element, but can sometimes be found naturally. When the element is crushed into powder, antimony expands as it becomes a brittle, silvery and hard solid. Do you know that a compound of antimony was used in ancient Egypt as a form of eyeliner known as kohl?

Antimony is used in the printing industry for type setting. The element is an important component in the production of batteries, bearings, and cable sheathing. The pure form of antimony is used to make certain types of semiconductor devices, such as diodes and infrared detectors. China is the top global producer of antimony, extracting between 84 per cent and 88 per cent of the supply. The atomic number of antimony is 51 and it is represented as Sb.

Who discovered tellurium?

Franz Joseph Muller von Reichenstein, an Austrian mineralogist, discovered tel-



lurium in 1782. However, it was Martin Heinrich Klaproth, a German chemist, who named it tellurium. The element was named after 'tellus' which in Latin meant earth.

Tellurium is one of the rarest elements on Earth. Its presence in nature is only as much as platinum. However, the element is abundant in space. One of the reasons for the rarity of the element is its volatile nature as it tends to escape to space as gas.

Tellurium is sometimes found in its natural form, but it is more often found combined with gold, or other metals in mineral forms.

Tellurium is added to copper and stainless steel to harden them, and improve their ability to be used in various machines. The element is also added to lead to make it harder, and more acid-resistant for use in batteries. The US Department of Energy has estimated that the demand for tellurium will cause a deficiency by 2025. Compounds of tellurium are toxic, and eating them causes very unpleasant body odours and bad breath.

The atomic number of tellurium is 52, and the symbol is Te.

Too Much is Too Little

Only one pound of tellurium is usually produced from the refining of 550 tonnes of copper!

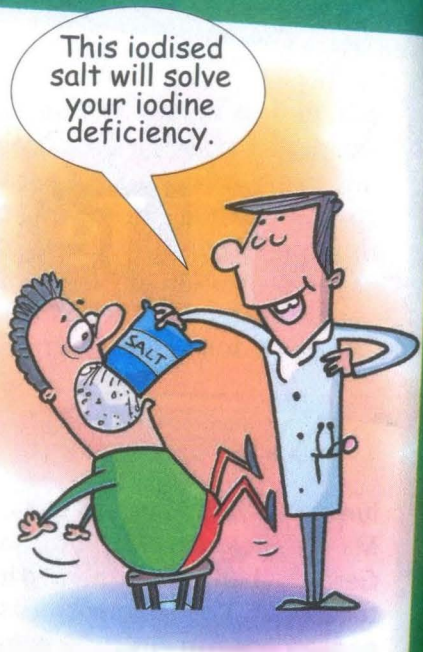
Does iodine play a significant role in the human body?

Iodine is a critical nutrient in human body; and therefore, it is an essential element for life itself.

Iodine is best known for the vital role it plays in thyroid hormone production in humans. Its deficiency can lead to serious health problems, such as intellectual disability, cretinism, which is a condition of severe stunting of physical and mental growth, and goitre, which is the abnormal enlargement of the thyroid gland.

Barnard Courtois, a French chemist, discovered iodine in 1811. He named it iodine from the Greek word 'iode' which means violet. In vapour form, the element is violet in colour.

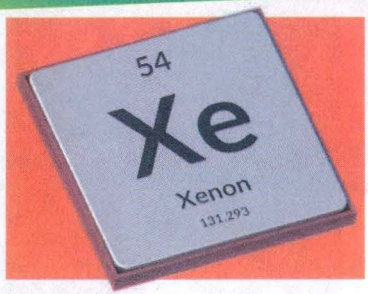
In solid form, the element is blue-black in colour. Iodine is fairly rare in both the earth's crust and in the solar system. It is the 63rd most common element in the earth's crust. Iodine is soluble in water; and therefore, it is found more abundantly in oceans.



Iodine has several commercial applications and can be found in a variety of pharmaceuticals, disinfectants, inks and dyes, catalysts, photography chemicals and animal feed supplements. However, it plays an important role in the production of medicines. Most iodine production in the world comes either from the Chilean caliche, a mineral, or from the oil field brines in the US.

The atomic number of Iodine is 53, and the symbol is I.

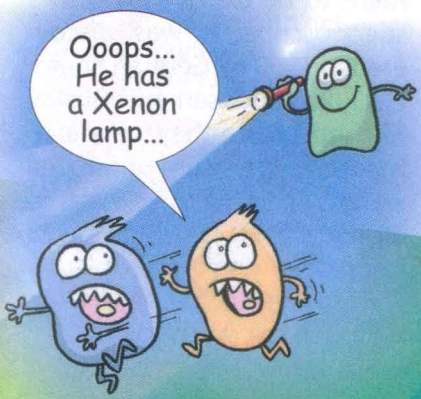
What are the specialities of xenon?



Xenon is a trace element in the earth's atmosphere. A trace element is an element whose presence in the atmosphere is negligible. Xenon is a very rare gas on our planet.

Xenon was discovered in 1898 by William Ramsay, a Scottish chemist, and Morris Travers, an English scientist, who had discovered krypton and neon in the previous years. All three elements were isolated in similar fashion. The scientists extracted them by evaporating liquid air, and studying what remained in it.

Although the gas is not very abundant in the earth's atmosphere, the amount of xenon is exceptionally high in other planets, especially Jupiter. Jupiter has almost three times more of xenon than the Sun. The element is found in Mars' atmosphere at about 0.08 parts per million.



Xenon emits a blue glow when charged by electricity. Therefore, the element is used for very powerful flash lighting, lights simulating sunbeams, fog lights, road signs, and germ-killing food lamps. Xenon is vital to space vehicles as the element is used to power their engines.

Although xenon is not toxic on its own, its compounds can be highly toxic. The atomic number of xenon is 54 and it is represented as Xe.

An Atomic Clock

What keeps atomic clocks so accurate?

An atomic clock is supposed to be one of the most accurate time-keeping devices in human history. Caesium is what powers an atomic clock as its atoms keep it exact. The atomic clock is the device used as the standard measure of time. A second in the atomic clock is defined as the amount of time taken by the caesium atom to vibrate 919,26,31,770times between energy levels!

Caesium is a rare element. It is a silver-white, shiny metal with brilliant blue spectral lines. The element's name comes from 'caesius', a Latin word meaning 'sky blue'. It is the softest metal, with a consistency of wax at room temperature.

Caesium will melt in your hands! However, be very cautious! The element might explode in the air, as it is highly reactive to moisture. Since caesium reacts violently with water, it is treated as a hazardous material, and is often kept under a layer of kerosene or mineral oil, or in a vacuum. This prevents the metal from reacting and igniting in the air.

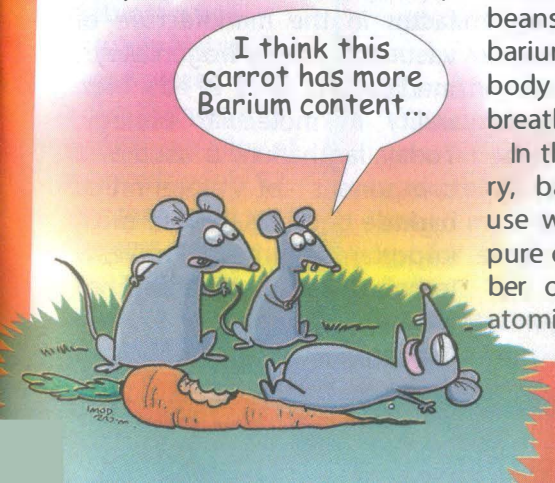
Caesium was the first element to be discovered with a spectroscope. It was discovered in 1860 by German chemists Robert Bunsen and Gustav Kirchhoff when they were analysing the spectrum of mineral water. Apart from its use in atomic clocks, caesium is used in excavation of petroleum. The atomic number of caesium is 55, and the symbol is Cs.

What are the characteristics of barium?

Barium is a soft silvery-white metal. The name of the element comes from the Greek word 'barys', meaning 'heavy'. It is not generally found in nature in its pure form. Only compounds of the metal are available in the earth's crust. Even though barium compounds were discovered in the 17th century itself, it was Humphry Davy who first isolated the metal in 1808.

Humphry Davy

Barium has a wide range of uses. The element is used in rat poison and oil drilling fluids. Barium has important diagnostic utilities too. Patients suffering from digestive problems are given a non-toxic mixture that contains barium before an x-ray. This mixture shows up clearly on x-rays, allowing doctors to locate and diagnose the problem.



An average adult human body contains about 22 mg of barium. Various vegetables that we consume everyday such as carrots, onions and beans contain barium. While barium does not build up in the body and is not a carcinogen, breathing its dust is unhealthy.

In the late nineteenth century, barium's key commercial use was in the production of pure oxygen. The atomic number of barium is 56 and its atomic symbol is Ba.

Can lanthanum be pulled into a string?

Lanthanum is a soft and ductile metal. Ductility means the ability of a substance to be stretched long. Lanthanum can be easily pulled into a string. The softness of the metal enables it to be sliced into pieces with a kitchen knife.

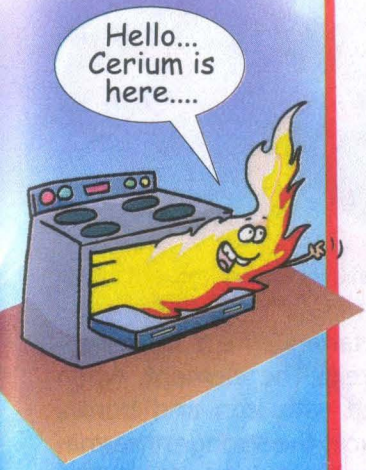
Lanthanum is silvery-white in colour. It was Carl Gustaf Mosander, a Swedish chemist, who discovered lanthanum in 1839. It wasn't until 1923, though, that a fairly pure sample of the element was produced. Lanthanum is traditionally considered a rare metal because it is rarer than most elements found in their pure form on Earth. However, the element, in fact, is not rare at all as the concentration of the element in the earth's crust is at about thirty-two parts per million.

Carl Gustaf Mosander

Lanthanum is an important factor in the manufacture of vacuum tubes, hydrogen alloys, medications, and it has high utility in molecular biology. Today, lanthanum is used as a component of nickel-metal hydride batteries, whose most important commercial utility is in hybrid cars. Lanthanum has the atomic number of 57, and its atomic symbol is La.

Risky Element!

Barium compounds are highly poisonous. Barium powder can ignite spontaneously in air.



Who discovered the element cerium?

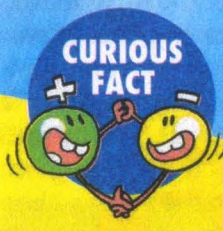
There are three scientists who are credited with the discovery of the element cerium. While Swedish chemists Jöns Jacob Berzelius and Wilhelm Hisinger discovered the element in Sweden, Martin Heinrich Klaproth, a German scientist, discovered it in his mother country. Both these discoveries were done independently of each other, in the year 1803.

Cerium is named after the asteroid Ceres, a dwarf planet, which was discovered in 1801. The planet's name derives from the Roman goddess of agriculture. Cerium is one abundant element.

Cerium is a grey silvery-white metal. It decomposes slowly in cold water, and very rapidly in hot water. It is found in several minerals including allanite or orthrite, monazite, bastnasite, cerite and samarskite. Large deposits of cerium have been found in India, Brazil and in Southern California.

Cerium burns when heated and is used in self-cleaning ovens. The film and television industry extensively uses it in carbon-arc lighting technology for studio lighting and projector lights.

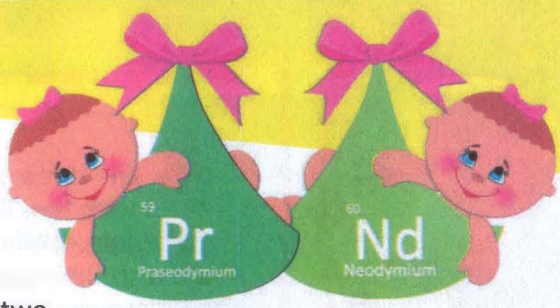
The atomic number of cerium is 58, and the atomic symbol is Ce.



That's not Gold!

Those gold Oscar statuettes are actually britannia metal plated with gold! Britannia metal is an alloy of approximately 92 per cent of tin and the rest, copper and antimony.

Why are praseodymium and neodymium unique?



Like twins, these two elements were born together! Carl Auer von Welsbach, an Austrian scientist, discovered neodymium and praseodymium at the same time. He separated the elements from a substance called didymium in 1885.

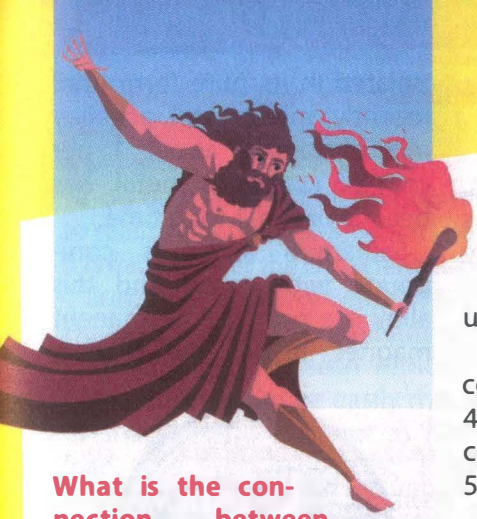
Praseodymium can be found in a variety of minerals. Larger quantities of the element are found in monazite and bastnasite. Praseodymium is commonly used as an alloying agent with magnesium to create high strength metals used in aircraft engines. The atomic number of praseodymium is 59, and the element is represented as Pr.

Neodymium is a soft and silvery metal. The element easily reacts with the air. Its uses are manifold. Neodymium's chief use is as a reddish-purple pigment for glass and ceramics. It is also used in cryocoolers that regulate heat in experiments with metals. Neodymium is an important element in certain fertilizers. The element, when alloyed with iron and boron, produces the strongest permanent magnets known to exist.

Neodymium has the atomic number 60 and it is represented as Nd.

Master Minds

Berzelius and Klaproth are major figures in the history of chemistry. Berzelius discovered selenium in 1817, and thorium in 1828 while Klaproth discovered both uranium and zirconium in 1789.



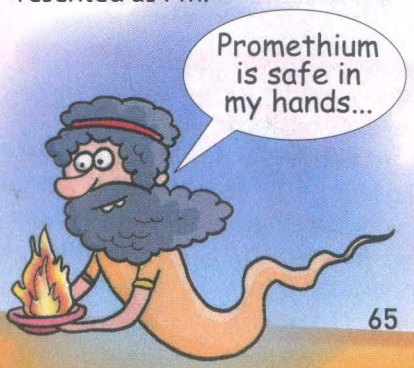
What is the connection between promethium and Prometheus, the Greek hero?

Prometheus is a legendary Greek hero. He is known as a trickster because he defied the gods and stole fire from them to give it to Man. Promethium is named after Prometheus. The reason is that the element glows in the dark like the fire of Prometheus!

The discovery of the element was the result of the hard work of four scientists: Charles D. Coryell, Jacob A. Marinsky, Lawrence E. Glendenin, and Harold G. Richter. They were trying to create fuel for an atomic bomb. The first identification and separation of the element happened in 1945. They were able to extract promethium-147, an isotope of the element, from the by-products of uranium fission.

The element had been discovered, in the spectrum of HR 465, a star in a constellation called Andromedae, which lies 520 light-years away from us.

The glow-in-the-dark promethium is a highly radioactive element. The element is not easily found anywhere on Earth. Due to its rarity, the element is primarily used for research. However, scientists look at it as an element with a variety of possibilities. It could be used in medical devices, batteries, and in luminescent paint. The atomic number of promethium is 61, and it is represented as Pm.



How did samarium get its name?

Vassili Samarsky-Bykhovets, a Russian mining engineer, was instrumental in the discovery of a particular mineral which was named 'samarskite' after his own name. Our element, samarium, was first extracted from this mineral, and thus, is named after it. Samarsky-Bykhovets may be the first person to be the namesake of an element, although indirectly.

Paul Émile Lecoq de Boisbaudran, a French chemist, discovered the element in 1879. The element is moderately hard, and greyish white in colour. It is fairly stable in the air and has a bright silver sheen. Samarium is found in many minerals, including monazite and bastnasite, which are commercially desirable sources. While samarium has not been isolated in its pure form until recently, mischmetal, an alloy mix containing about 1 per cent of samarium metal, has been in use for a long time.

Samarium forms a compound with cobalt and this alloy is a powerful permanent magnet. It has the highest

resistance to demagnetisation of any known material. The element is used as a neutron absorber in nuclear reactors and in infrared absorbing glass.

The atomic number of samarium is 62, and it is represented as Sm.

Perfect Prediction

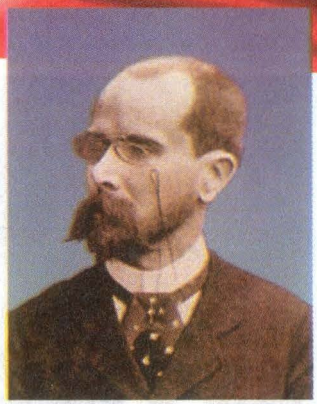
The existence of an element between neodymium (No. 60) and samarium (No. 62) was first predicted by Bohuslav Brauner, a Czech chemist, in 1902.

How did europium and gadolinium get their names?

You do not have to think too much to realise how europium got its name. It is named after the continent Europe.

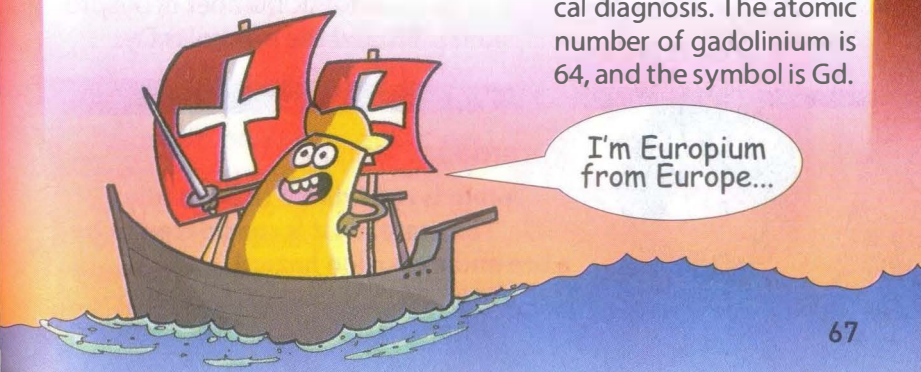
Europium is silvery white in colour. However, since the element reacts with air, it is rarely seen without discolouration. It can be easily moulded or shaped, and is about as hard as lead. The French chemist, Eugene-Anatole Demarcay, is credited with the discovery of the element as it was he who ultimately produced a relatively pure form of europium in 1901. Although humans had been using this element and had known of its existence, it took many years for man to isolate the element properly.

Europium can be found in the ores bastnasite and monazite. The element has also been identified in the sun, and some other stars. The atomic number of europium is 63, and it is represented as Eu.



Eugene-Anatole Demarcay

Gadolinium is also silvery white in colour in its pure form. It is named after the mineral gadolinite, one of the minerals in which gadolinium is found. It is a malleable and ductile element. Its magnetic properties allow it to be tracked through the human body; and therefore, it is used for magnetic resonance imaging in medical diagnosis. The atomic number of gadolinium is 64, and the symbol is Gd.



Frank Spedding

What are the characteristics of terbium and dysprosium?

Terbium is a silvery-white element, which is malleable and so soft that it can be cut with a knife.

It is named after the Swedish village of Ytterby, where the first sample of the element was found.

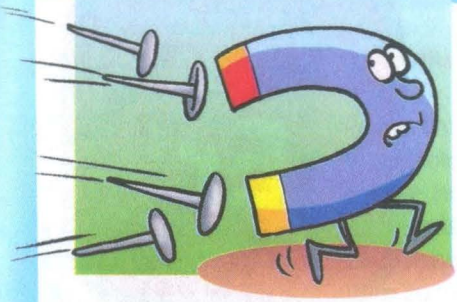
In 1843, Swedish chemist Carl Gustaf Mosander separated the mineral gadolinite into three materials, which he called yttria, erbia and terbia. From two of these substances, he discovered erbium and terbium. Erbium and two other elements namely ytterbium and yttrium are also named after Ytterby. Although terbium is relatively stable in the air, it reacts with water when exposed to it. It's used in x-ray imaging screens and CDs. Terbium has the atomic number 65, and is represented as Tb.

Dysprosium is a soft silvery metal. The element was discovered in 1886 by Paul-Émile Lecoq de Boisbaudran, a French chemist, but he was not able to isolate it. It was not isolated until 1950, when Canadian scientist Frank Spedding and his team developed ion-exchange separation and metallographic reduction techniques.

Dysprosium is not currently used for a wide range of applications except when there is no other alternative. The atomic number of dysprosium is 66, and the symbol is Dy.

Hazardous Element

Europium is considered to be mildly toxic. The metal dust is considered to be a fire and explosion hazard.



Does the element holmium, and the city Stockholm have anything in common?

Stockholm is the capital city of Sweden. Holmium is named after this city which is known as Holmia in Latin.

The element was discovered spectroscopically by Marc Delafontaine and Jacques-Louis Soret in 1878. Per Teodor Cleve, a Swedish chemist, discovered the element independently in 1879, and he named it after his hometown, Stockholm. The pure metal was isolated in 1911, by Otto Holmberg.

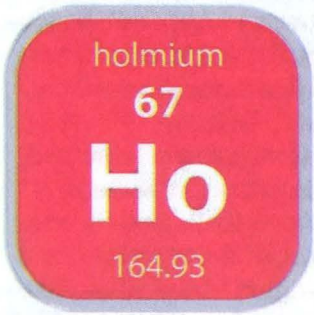
Holmium is a bright, soft, silvery white element. The element has some special magnetic properties and they enable holmium to be used in alloys for the production of magnets. Holmium magnets can, in fact, create the strongest magnetic fields. Holmium is also used in nuclear reactors.

Holmium is not generally seen as a free element in nature but is found in compounds in a number of minerals such as gadolinite and monazite.

It is commercially extracted from monazite and occurs in that mineral at a rate of about 0.05 per cent.

Holmium is mainly used in laser surgery. There are not many commercial uses for the element.

The atomic number of holmium is 67, and it is represented as Ho.



Why is erbium named so?

As we have already seen, many elements were discovered in the Swedish village Ytterby. The element erbium was one among them, and was discovered in 1843. It was the Swedish chemist Carl Gustaf Mosander who discovered the element. Mosander was working with a sample of what was thought to be the single metal oxide yttria, derived from the mineral gadolinite. He extracted three segments from it and called them yttria, erbia and terbia. As might be expected considering the similarities between their names and properties, scientists soon confused erbia and terbia. Mosander's terbia became known as erbia after 1860, and the earlier known erbia was renamed terbia after 1877!

It is difficult to find natural erbium independently on earth as it is always found in chemical compounds. Erbium has a special ability to absorb harmful infra-red rays. Therefore, the element is used in the glass of safety goggles for welders.

Erbium occurs in a variety of minerals, including gadolinite, euxenite, xenotime, fergusonite, polycrase and blomstrandine.

The atomic number of erbium is 68, and its symbol is Er.

IUPAC

The International Union of Pure and Applied Chemistry, IUPAC, is an international federation, established in 1919. It is best known for standardising nomenclature in chemistry. It also standardises the atomic weights of the elements.

● *Ryan Thomas*

Is thulium used in Euro banknotes?

Yes, thulium is used in Euro banknotes to prevent counterfeiting. The element in the note displays blue fluorescence under ultraviolet light thus aiding in distinguishing between the real and the fake currency note.

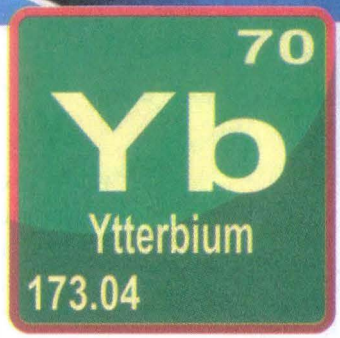
Thulium gets its name from the name of an ancient place called Thule which is associated with Scandinavia. Per Teodor Cleve, the Swedish chemist, discovered two new materials, one green and one brown, while working with erbia (erbium oxide) in 1879, in Uppsala, Sweden. These turned out to be oxides of two new elements: thulium and holmium. The green substance he named thulia, which he later found to be thulium oxide, and the brown substance he named holmia, which he later found to be holmium oxide. Charles James in New Hampshire, prepared the first pure thulium in 1911.

This element does not have many uses as it is rare, and therefore, costly. There are many cheaper elements that can substitute thulium. It is used in laser equipment and X-ray devices. The atomic number of thulium is 69, and its atomic symbol is Tm.

What are the characteristics of ytterbium?

Ytterbium is a bright metal with silvery white colour. It is a soft metal, and is both ductile and malleable. The metal tarnishes quickly in air, and reacts slowly with water. Ytterbium is considered to be moderately toxic. Closeness to the compounds of ytterbium can cause irritation to skin and eyes.

Jean Charles Galissard de Marignac, a Swiss chemist, is reputed to have discovered ytterbium in 1878. However, ytterbium as a pure metal was produced only in 1953, at the Ames Laboratory, Iowa, by A. Daane, David Dennison and Frank Spedding. The element is named after Ytterby, a village in Sweden.



Very rarely is ytterbium found free in nature. However, the element is abundantly available in a number of minerals such as monazite, gadolinite euxenite and xenotime.

There are many isotopes of ytterbium. Isotope 160Yb is radioactive, and is used in portable x-ray machines that need no electricity. It is used in stress gauges to monitor ground deformations caused by earthquakes or underground explosions. Atomic clocks also use ytterbium for accuracy of time.

The atomic number of ytterbium is 70, and its atomic symbol is Yb.

Orpiment

The Ancient Egyptians used many colourful minerals to decorate their temples and tombs. Some of the minerals they used such as orpiment, were poisonous.

What is common between lutetium and Paris?

There is an interesting story behind the naming of the element now known as lutetium. Lutetium was discovered in 1907 independently by three scientists. They were Charles James, an American scientist, Georges Urbain, a French chemist, and Carl Auer von Welsbach, an Austrian mineralogist. When it came to naming the element, there was a dispute among them. Urbain, a French by birth, proposed two names, one of which was 'lutecium', conceived from Lutetia, the Roman name for Paris. Welsbach had some other ideas. Both of them accused each other of using each other's research details as well. Anyhow, Urbain's name was accepted, and it gained popularity with a small change in spelling –from lutecium to lutetium.

The element has not been isolated until recent years, and it is one of the most difficult ones to prepare. There are very few commercial uses for lutetium because it is too expensive, and too difficult to extract.

The atomic number of lutetium is 71, and its symbol is Lu.

Kohl of Death

The ancients used crushed antimony as black paint. They even used it as eyeliner. But they did not know how dangerously toxic it was.

Is hafnium used in submarines?

Hafnium is a silvery grey shiny metal. The element is named after Hafnia, the Latin name for Copenhagen, the capital city of Denmark. It is there that the element was discovered.

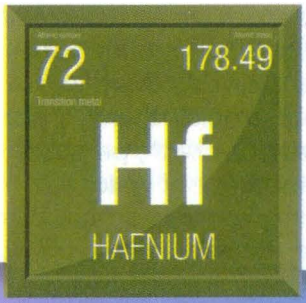
Hafnium nuclei has the ability to absorb multiple neutrons; and therefore, it is used in nuclear reactors, especially nuclear powered submarines.

Dmitri Mendeleev had predicted the possible existence of hafnium. He predicted an element with similar features in his report in 1869. However, it had not been discovered until 1923 by Dirk Coster, a Dutch physicist, and Georg von Hevesy, a Hungarian radio-chemist.

Hafnium has many interesting features. It reacts with air and forms a film to protect itself. Due to this tendency of the metal, hafnium is very resistant to corrosion. A single fine particle of hafnium can spontaneously combust when it comes in contact with air.

Hafnium does not exist in nature on its own. It is usually found combined with zirconium to form minerals. Hafnium is used in the manufacture of alloys with several metals, including iron, niobium, titanium, and tantalum.

Hafnium has the atomic number 72, and it is represented as Hf.



What makes tantalum special?

Do you know how the element tantalum gets its name? There is a Greek mythological figure called Tantalus who was sentenced for his heinous crimes. He was punished to eternally stand in a stream, beneath a tree with fruit-laden branches, never being able to satiate his hunger or quench his thirst. The element tantalum is named after this villainous character.

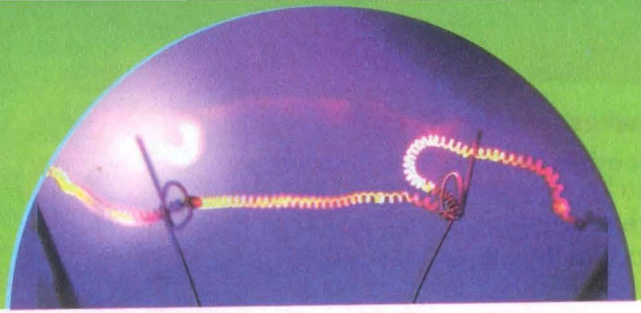
Tantalum was discovered by Anders Ekeberg, a Swiss chemist, in 1802. Ekeberg was an expert in Greek literature, and he was deaf!

The element is blue-grey in colour, and is a very hard metal with the fourth highest melting point of any metallic element. It is well known for its ability to resist corrosion by acids, even aqua regia, a strong acidic mixture of nitric acid and hydrochloric acid.

There is a wide variety of minerals that contain tantalum, but only five are viable for commercial uses at present. They are euxenite, microlite, polycrase, tantalite, and wodginite. Of these minerals, tantalite is the most important for tantalum mining.

Tantalum is mainly found in Australia, Brazil, Mozambique, Thailand, Portugal, Nigeria, Zaire and Canada. It is used in a variety of alloys to add high strength, ductility and a high melting point.

The atomic number of tantalum is 73, and its atomic symbol is Ta.



What makes tungsten one of the most useful elements?

Thomas Alva Edison is probably a familiar name to everyone. He was an inventor who is credited with the invention of light bulb.

After so many trial and error experiments with metal for the filaments, he came across a metal which was suitable for the bulbs. It was none other than tungsten.

Tungsten is most used for the filaments of light bulbs and other types of lighting, because it has the highest melting point of all the metals. It ranges in colour from a steely grey, to almost white.

Carl Wilhelm Scheele, a German-Swedish chemist, hypothesized the existence of tungsten in 1781. Two years later, Spanish chemists, Jose and Fausto Elhuyar isolated tungsten.

The name tungsten comes from the Swedish words 'tung sten', meaning heavy stone. Tungsten is the heaviest of all elements known to play a biological role. Tungsten is resistant to attack by alkali, oxygen, and acids. Production of tungsten is difficult, due to its high melting point.

It has the atomic number 74, and its atomic symbol is W.

The symbol comes from its alternative name wolfram used by German tin miners.

What are the characteristics of rhenium and osmium?

Rhenium is a tough metal. It is silvery grey in colour, and very heavy.

Three German chemists, Walter Noddack, Ida Tacke, and Otto Berg are credited with the discovery and naming of the element in 1925.

They reported that they had detected the element in platinum ore and in the mineral columbite. They also found rhenium in gadolinite and molybdenite. The trio named the element after the Rhine River in Germany.

Rhenium has the highest boiling point of any of the elements. The single most common commercial use for rhenium is in the alloys that make up jet engines. Rhenium has the atomic number 75, and its atomic symbol is Re.

Osmium is a hard and brittle metal, in bluish white colour. The name comes from the Greek word osme, which means smell, scent or odour. British chemist Smithson Tennant discovered osmium in 1803. The atomic number of osmium is 76, and its atomic symbol is Os.

Itai-Itai

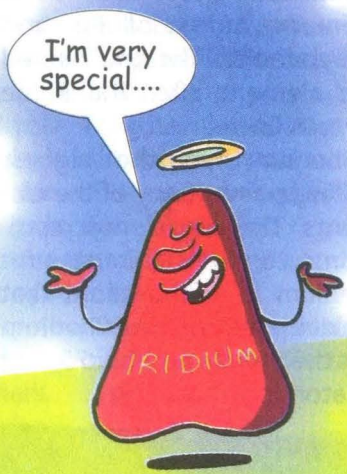
A painful weakening disease known as Itai-Itai in Japan was caused by eating rice grown on soil contaminated with high levels of cadmium.

Is the nib of a Parker pen made of iridium?

Do you use a Parker fountain pen? A Parker 51 pen's nib has iridium in it.

The discovery of iridium is very similar to that of osmium. Scientists dissolved platinum in aqua regia, only to find a dark insoluble residue that resembled graphite forming in the liquid. Smithson Tennant, an English chemist, noticed that the residue contained two elements osmium and iridium in 1803. In 1804 he published his work and officially named both elements that he had accidentally discovered.

Iridium is a very hard and brittle metal. It is one of the densest elements, second in density only to osmium. Iridium is one of the rarest metals and the most corrosion-resistant one. Therefore, it is used for deep water pipes and for the contacts in spark plugs. The element has utility in spacecraft engineering and telescope manufacture. Iridium is a member of the platinum family, and is white in colour, with a yellowish hue. Though it is not abundant in the earth's crust, Iridium's presence in meteorites is considerable. Due to the difficulty in extracting iridium, there are not many industrial applications for the element. However, its alloys are used widely. Iridium's atomic number is 77, and it is represented as Ir.

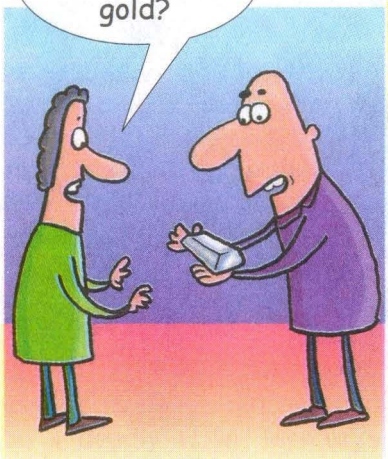


Why is platinum costly?

People love to wear on their body expensive metals such as silver, gold and platinum in the form of ornaments. While silver and gold are common jewellery, platinum is not as common due to its high cost.

Ancient civilizations of Central and South America have used platinum for centuries. Archaeologists have discovered traces of the element in the gold used by the Ancient Egyptians as early as 1200 BC. However, scientists started to study the element only after European exploration of the Americas began.

Platinum, a highly valued and desired metal, has a wide range of uses, including jewellery, electrical contacts, pacemakers, drugs and magnets. Platinum tends to be very expensive because of its rarity. Platinum is a silvery white metal. It was once known as 'white gold' due to its colour and cost. It is highly resistant to tarnishing and corrosion and is very soft and malleable.



Though it is rare in the earth's crust, the earth's moon and meteorites often contain great deposits of platinum. South Africa is the leading producer of refined platinum. The atomic number of platinum is 78, and its atomic symbol is Pt.

What makes gold people's favourite metal?

Gold is an indispensable metal in our life. People wear gold ornaments during special occasions such as weddings and festivals. For people, gold

ornaments are not only highly sought-after accessories but also a secure investment option due to its consistent price. What makes gold such a desirable metal?

Gold has been prized for its yellow colour and shine since prehistoric times. It is popular mainly because its glow hardly diminishes. The glittering element has the ability to excite people like no other. Gold's chemical symbol is Au, which comes from the Latin word 'aurum', meaning glow of sunrise.

Gold is the most workable metal. It is soft and can be hammered into incredibly thin sheets called 'gold leaf'. Gold has diverse utilities as it is used for teeth filling, jewellery, electrical circuit boards, space satellites and coins.

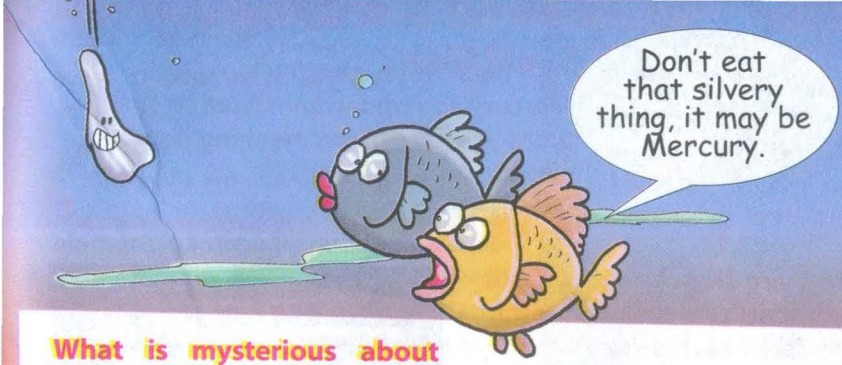
The amount of gold in an object is measured in carats. Pure gold is 24 carats. A carat was originally a unit of weight based on the carob seed or bean, and it was used by ancient merchants in the Middle East.

The atomic number of gold is 79.

Kilogramme

The unit of weight, is officially determined by a platinum-iridium cylinder made in 1879.

• *Shijo Varghese*



What is mysterious about mercury?

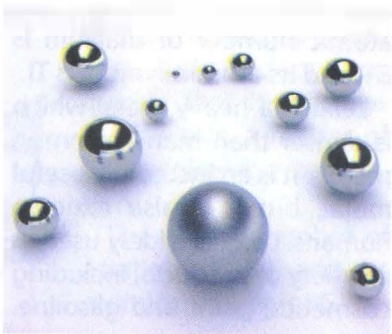
Mercury has always been surrounded by mysteries. From ancient times, people had been intrigued by its dubious form and ambiguous nature. Mercury is a metal in liquid form. Alchemists thought that mercury was the primordial matter from which all other metals originated. They even believed that mercury could be turned into gold by chemical experimentation.

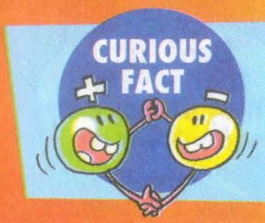
The metal is the heaviest liquid in the world. The liquid element is easily obtained, and fascinating to look at -no wonder people thought it was magical. It's found in every living thing; and is, therefore, in every mouthful of food we eat.

Mercury is also called quicksilver because it is silvery, and moves about quickly, without getting stuck to the surface.

Mercury is extracted by heating cinnabar, a red mineral. This is most abundant in Spain, Russia and China.

All forms of mercury are dangerous. However, methyl mercury is the most poisonous variant. Once valued as a medicine, mercury is now proven to be a deadly toxin. Mercury's atomic number is 80, and it is represented as Hg.





Liquid Silver

Mercury's symbol comes from its Latin word 'hydrargyrum', meaning liquid silver.

How are the elements thallium, lead and bismuth different from each other?

Thallium is a silvery white metal that tends to react with air when exposed to it. Two scientists, William Crookes, an English physicist, and Claude-Auguste Lamy, a French chemist, discovered thallium independently of each other in 1861. Thallium was named after the Greek word thallos, meaning 'a green shoot' or 'a tree twig'. Thallium salts are used in rat and insect poisons. The element plays a significant role in nuclear medicine. The atomic number of thallium is 81, and its atomic symbol is Tl.

Lead is a heavy metal which is denser than many common metals. It is an incredibly useful metal, but it is also toxic to humans. Lead is widely used in a variety of products, including cosmetics, paint and gasoline.

The chemical symbol for lead is Pb, which comes from the Latin word 'plumbum', meaning plumbing or waterworks. It has the atomic number 82.

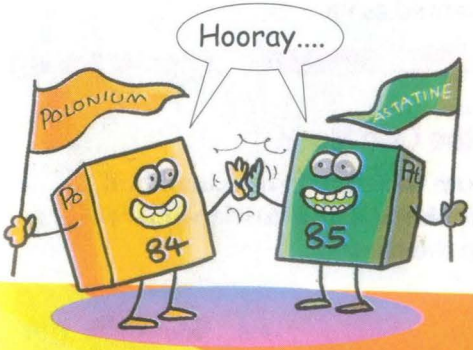
Bismuth is a shiny brownish-silver metal. It is represented as Bi, and has the atomic number 83. Bismuth has been in use since ancient times, and was previously confused with both lead and tin. While no single person is credited with its discovery, it wasn't until 1753 that Claude Geoffroy, a French chemist, discovered that it was a separate element.

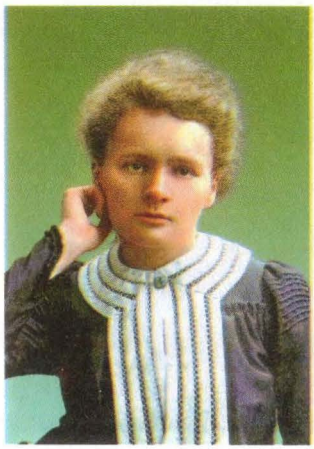
Who discovered polonium and astatine?

Polonium was discovered by Marie Curie, a Polish physicist, in 1898. This element is a strongly radioactive metal. Polonium takes its name from Poland, Marie Curie's motherland. Poland then was not an independent country and Curie hoped that naming the element after Poland would make her country's plight known to the world!

Marie Curie isolated polonium from uranium ores and pitchblende, a uranium-rich mineral, in which it exists in tiny amounts. Polonium is used in nuclear reactors. It is represented as Po, and its atomic number is 84.

The existence of astatine had been predicted in the 1800s. Mendeleev in his periodic table had left an empty space after iodine, signifying a yet-to-be-found element. Astatine, however, was discovered much later in 1940





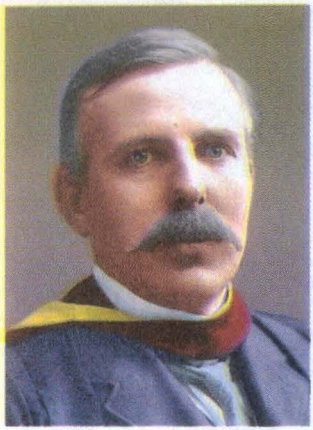
Marie Curie

by Dale Corson, Kenneth McKenzie and Emilio Segre at the University of California, Berkeley.

Astatine is the rarest element on Earth; approximately 25 grams occur naturally on the planet at any given time.

Astatine has an important use in nuclear medicine, but it decays so quickly that it must be used within a matter of hours following production.

The atomic symbol of astatine is At, and its atomic number is 85.



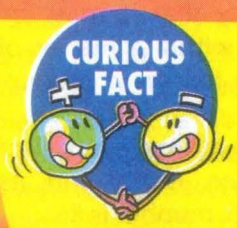
Ernest Rutherford

What characteristics make radon, francium, and radium unique?

Can an element eventually become another element? Radon is produced when the element radium slowly decays. The element was discovered by Ernest Rutherford and Robert B. Owens. Radon is a colourless and odourless gas; however, it is dangerous because it gives off radiation. Some spas in Japan and Austria specialise in radon bathing, which supposedly makes people feel young and energetic again. It is represented as Rn, and its atomic number is 86.

Francium is named after the country of France. Francium was discovered by Marguerite Perey, a French chemist. It is an intensely radioactive element. It is one of the rarest elements in nature. Francium's atomic number is 87, and it is represented as Fr.

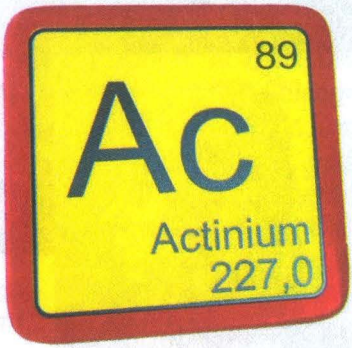
Radium is a silvery white metal that quickly reacts with nitrogen in the air. The name of the element comes from the Latin word radius, meaning 'ray', as radium glows faintly in the dark. It is a poisonous, heavy, and radioactive metal. The element was discovered by Marie Curie and Pierre Curie. It has the atomic number 88, and is represented as Ra.



Up in the Cold Moon

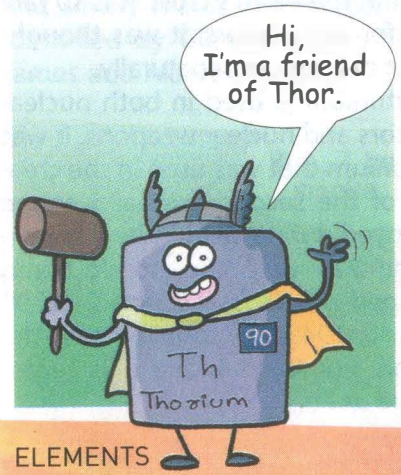
Polonium was used in the Lunokhod 1, and Lunokhod 2, the Russian lunar rovers, to keep them warm.

What are the element numbers 89, 90 and 91?



Element number 89 is actinium. The element, discovered by Friedrich Oskar Giesel in 1902, is a silvery white radioactive metal. The word actinium comes from the Greek word 'aktis' or 'aktinos', which means beam or ray. It is so radioactive that it glows in the dark. The element's radioactivity, its rarity, and hence its high cost have made actinium the least industrially useful element. Actinium is represented as Ac.

Element number 90, thorium, is named after Thor, the Nordic god of thunder, lightning and storm. A highly radioactive element, thorium is a silvery, lustrous metal. It is potentially an alternative to uranium in fuelling nuclear reactors. In its liquid state, thorium has a greater temperature range than any other element, with nearly 3,000 degrees Celsius. Since thorium is a health hazard, its use has steadily come down over the years. It is represented as Th.



Protactinium, is a bright silvery metal. The element with the atomic number 91 decays to form another metal actinium. The name protactinium means before actinium. Discovery of the element is attributed to Otto Hahn and Lise Meitner. The element was isolated by Aristid von Grosse. It has no known uses.

Protactinium's atomic symbol is Pa.

Martin H. Klaproth

What are the characteristics of uranium, neptunium and plutonium?

Uranium is named after the planet Uranus and the Greek god of the heavens. The element is radioactive; and therefore, exposure to the element by humans can pose immediate threat to life. Uranium, a silvery white metal, was discovered and identified in 1789 by a German chemist, Martin H. Klaproth. This important element is used as fuel in nuclear reactors to generate electricity. It has the atomic number 92, and its atomic symbol is U.

Neptunium is the element number 93. It was discovered by Edwin McMillan and Philip Abelson, American physicists, in 1940. Compared to uranium, neptunium is not very radioactive. Neptunium's current applications are limited. The element is represented as Np.

Under standard conditions, plutonium is a hard, brittle, silvery metal. Plutonium is an extremely rare element in the earth's crust. It is so rare that for many years, it was thought that it did not occur naturally.

Plutonium is used in both nuclear reactors and nuclear weapons. It was plutonium that was used in the creation of the second nuclear weapon deployed during World War II known as the 'Fat Man', the atomic bomb dropped on Nagasaki, Japan, on 9th August 1945. Plutonium has the atomic number 94, and it is represented as Pu.

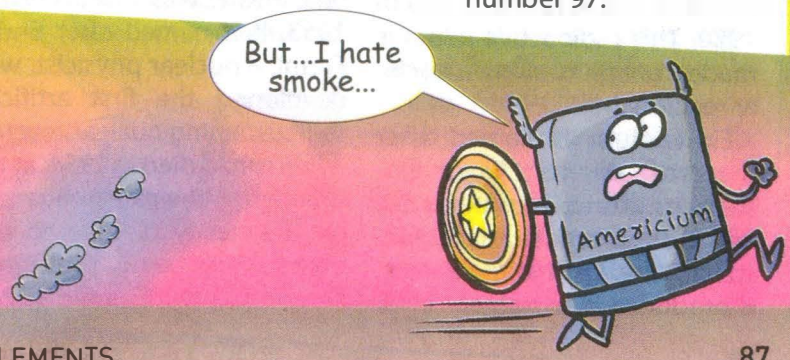
How did americium, curium and berkelium get their names?

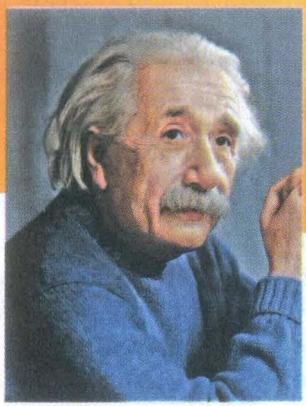
Americium is named after the Americas. Americium, is created during the nuclear reactions of heavy elements. Scientists say that before its actual production in 1944, the element would have been likely created during nuclear experiments!

Americium is a highly radioactive element that can be dangerous when handled incorrectly and can cause severe illnesses. This element's main use is in smoke detectors as part of fire-safety measures as it produces a tiny current that triggers alarm when it meets with particles of smoke. Its atomic number is 95, and it is represented as Am.

Curium is named in honour of Pierre and Marie Curie. It is a hard, dense and silvery metal. The element was identified by Glenn Seaborg, Ralph James and Albert Ghiorso in 1944 at the wartime metallurgical laboratory at the University of Chicago. Curium is produced from plutonium, and is used as a power source for pacemakers, navigational buoys and spacecraft. It has the atomic number 96, and its atomic symbol is Cm.

Berkelium is named after a city called Berkeley, in California, where it was first discovered. Obtained from plutonium in nuclear reactors, less than one gram of it is produced each year. There is hardly any industrial significance for the element, other than scientific research. Berkelium is represented as Bk, and it has the atomic number 97.





Albert Einstein

Laborious Job

The researchers at first referred to americium as 'pandemonium', meaning 'devil's assembly' in John Milton's *Paradise Lost*, owing to the difficulty they encountered trying to isolate it.

• *Sneha Rao*

How did the elements 98, 99 and 100 have such curious names?

Element 98 is californium. It is a synthetic, radioactive element which is not found in nature. Californium represented with the symbol Cf, is named after the University of California, where it was first made in 1950. This radioactive metal is made from plutonium in nuclear reactors.

Einsteinium is named after the great scientist Albert Einstein. Its atomic number is 99, and it is represented as Es. Einsteinium, a synthetic element, is produced in extremely small amounts, and has a very short lifetime. Einsteinium was discovered during the examination of debris from the first hydrogen bomb test in November 1952.

Element number 100 is fermium, and it was discovered in 1953. It is named after Enrico Fermi, a nuclear physicist, who developed the first artificial, self-sustaining nuclear reactor.

Fermi had died in 1954, at the time when the research results on the newly discovered element were being presented. Fermium is represented as Fm.

What makes mendelevium, nobelium and lawrencium special?

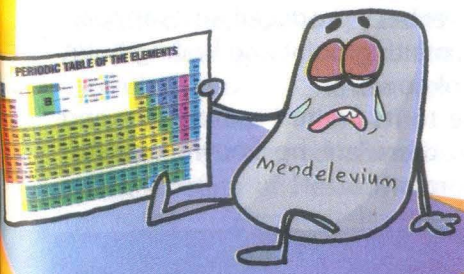
Three great scientists are honoured in the naming of these elements.

Mendelevium is a synthetic element named after Dmitri Mendeleev, father of the periodic table. Glenn Seaborg, Albert Ghiorso, Gregory Choppin, Stanley Thompson, and Bernard Harvey synthesised the element mendelevium in 1955. The first sample of mendelevium was only seventeen atoms! Due to its rarity, there are no known commercial applications for the element. The atomic number of the element is 101, and it is represented as Md.

Nobelium is named after Alfred Nobel, the inventor of dynamite and benefactor of the Nobel Prize. The element was officially discovered in April 1958 by Albert Ghiorso, Glenn Seaborg, Torbjorn Sikkeland and John R. Walton. As nobelium has been produced only in small quantities, its use is restricted to scientific research alone. It has the atomic number 102, and the atomic symbol, No.

Alfred Nobel

Lawrencium is named after Ernest Lawrence, inventor of the cyclotron, a particle accelerator, in which radioactive elements are isolated. There are no known commercial uses for lawrencium, as it does not occur naturally. The atomic number of lawrencium is 103, and its atomic symbol is Lr.



What are the characteristics of the elements 104, 105 and 106?

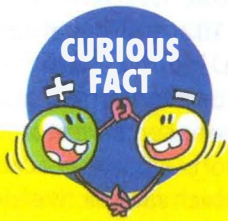
Element number 104 is rutherfordium. It is named after the great scientist Ernest Rutherford, who was one of the first men to explain the structure of the atom. A synthetic element, rutherfordium is not found in nature in its pure form but is created in a laboratory. The element was discovered by a team of researchers working at the Nuclear Institute in Dubna, Soviet Union. Although the Dubna team had claimed its discovery in 1968, another team at Berkeley also claimed discovery in 1970. Its atomic symbol is Rf.

Dubnium is a highly radioactive synthetic metal. The element is represented as Db, and its atomic number is 105. It is named after the Russian town of Dubna, where it was first produced. Dubnium behaves similarly to tantalum, but its chemical properties have not been fully confirmed.

Seaborgium has the atomic number 106, and is represented as Sg. This element is named after Glenn Seaborg, an American physicist, who has significantly contributed to nuclear chemistry.

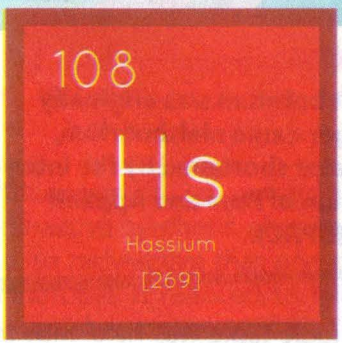
The element was discovered by the scientists at Lawrence Berkeley National Laboratory in 1974. No observable amount of the element has ever been produced, so its appearance, melting point and boiling point are unknown.

Due to its limited sample size and rarity, there are no known uses for seaborgium.



Most Stable

There are sixteen known isotopes of mendelevium. The most stable isotope is Md-258.



What are the features of bohrium, hassium and meitnerium?

Bohrium is a synthetic element named after Danish physicist Niels Bohr, who was the first scientist to correctly explain atomic structure. Bohrium is one of the later discoveries, as it was not fully discovered until 1987.

A German research team under the direction of Peter Armbruster and Gottfried Munzenberg successfully synthesized the element at Darmstadt, Germany. It has the atomic number 107, and is represented as Bh.

Hassium is named after the German state of Hesse, home of the German Nuclear Research Institute. Peter Armbruster, Gottfried Munzenberg and their colleagues discovered hassium in 1984, around the same time they discovered bohrium. A Russian team was the first to attempt to synthesise hassium in 1978. However, they were unsuccessful. It has the atomic number 108, and it is represented as Hs.

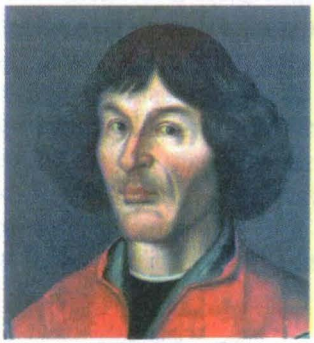
Meitnerium is an intensely radioactive synthetic element. It is named after Lise Meitner, Austrian physicist, who first suggested that radioactive atoms could spontaneously split apart releasing energy. Meitnerium was discovered by the same team of German researchers who isolated hassium and bohrium. Its atomic number is 109, and symbol is Mt.

Shorter Name

The element bohrium was originally given a longer name nielsbohrium, which was later shortened by the International Union of Pure and Applied Chemistry (IUPAC).

What are the element numbers 110, 111 and 112?

Darmstadtium is a synthetic element and it has the atomic number 110. The element is named after the city of Darmstadt, Germany, where it was first produced. Prior to its official discovery, darmstadtium's place on the periodic table was held with the placeholder name of 'ununnilium'. Its current name was officially assigned in 2003 by the IUPAC. It is believed to have somewhat similar properties to nickel, palladium and platinum. Darmstadtium is represented as Ds.



Nicolaus Copernicus

Element number 111 is roentgenium, a synthetic element. It is an extremely radioactive element. Roentgenium is named after Wilhelm Conrad Röentgen, the German physicist who discovered X-rays. It was first synthesized in 1994. Roentgenium is represented as Rg.

Element number 112 is copernicium, a radioactive element created in a laboratory. Copernicium is named after Nicolaus Copernicus, the famed astronomer. The symbol Cp was initially recommended for element 112, but was rejected, because Cp had once been used as the symbol for lutetium, which, prior to 1949, was sometimes called cassiopeium. Now the element is represented as Cn.

What qualities make nihonium, flerovium and moscovium special?

Nihonium is an extremely radioactive synthetic element. It is so radioactive that one of its isotopes is reduced to half its initial quantity within 10 seconds! Very little is known about nihonium. It is classified as a metal, and is expected to be solid at room temperature. The first undisputed claim of its discovery was made in 2004 by scientists from Japan. It was in November 2016, that the International Union of Pure and Applied Chemistry (IUPAC) approved the name nihonium for element 113. It is represented as Nh.

Flerovium is named after Georgy Flyorov, founder of the Joint Institute of Nuclear Research in Russia, where the element was discovered. Flerovium is a radioactive element about which little is known. There is hardly any use for flerovium, outside experimental interests. The atomic number of the element is 114, and it is represented as Fl.

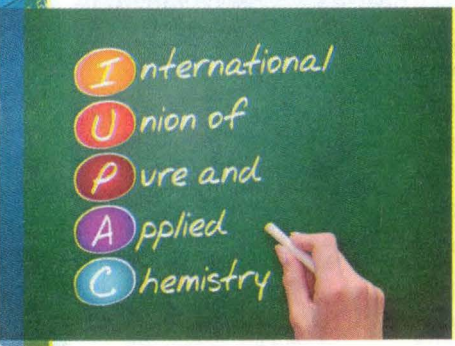
A synthetic element, moscovium was first synthesized in 2003. The element is named after Moscow Oblast, Russia, where the element was first synthesized. Moscovium has the atomic number 115, and is represented as Mc.

Two Claims

Gerhard Schmidt and Marie Curie discovered, independently, that thorium was radioactive in 1898. However, Schmidt is often credited with the discovery.

How do we describe the elements livermorium, tennessine and oganesson?

Livermorium, the element number 116, is named after the Lawrence Livermore National Laboratory in California. The element was first synthesized by the scientists of JINR, Dubna, in 2000. The name was officially given by the International Union of Pure and Applied Chemistry on May 23rd, 2012. An extremely radioactive element, Livermorium can be produced only artificially; and therefore, little is known about it. The element is represented as Lv.



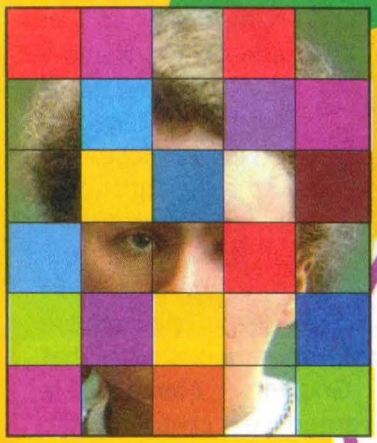
Tennessine is a radioactive element. It is artificially produced in a lab. Since the element is not found naturally in the universe, nothing much is known about it. The element is expected to be a solid, but its classification is unknown. In November 2016, the International Union of Pure and Applied Chemistry (IUPAC) approved the name tennessine for element 117, after the American state, Tennessee. The element is represented as Ts.

Oganesson is a radioactive, artificially produced element about which little is known. It is expected to be a gas. The atomic number of oganesson is 118, and the symbol is Og.

A Joint Venture

Tennessine was discovered in 2010, and was jointly announced on April 5 of that year by the scientists of JINR in Dubna, Russia, and LLNL in California, USA.

HIDE n' SEEK!



Here's a contest for our readers. Can you identify this great scientist? All you need to do is send us an e-mail, naming the person.

(PLEASE GIVE YOUR POSTAL ADDRESS AND PHONE NUMBER ALSO IN THE E-MAIL)
You are also welcome to send your answers by post.

Ten winners will be awarded prizes. In case there are more than ten correct entries, the winners will be chosen by lot.

FOR 10 LUCKY WINNERS

SCIENCE SET 2 in 1

Telescope & Microscope

If you are sending your entry by post, superscribe this on your envelope.
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P.B. No. 226, Kottayam, Kerala, INDIA.
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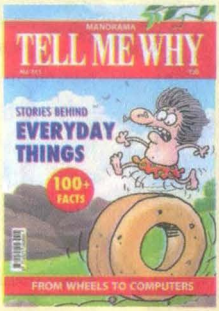
Our e-mail address:
childrensdivision@mmp.in
Please enter **HIDE n' SEEK!** in the subject line of your email.

Last date to receive entries:
2018 AUGUST 01

Corrections & Clarifications



Harsh Kumar Sharma, Gurgaon, points out a correction to the Tell Me Why issue on Stories Behind Everyday Things (June). He refers to Page 5, where it is wrongly mentioned that friction matches had tips coated with potassium chloride and antimony sulphide paste. In fact, they are coated with potassium chlorate and antimony sulphide.

Soumen Das, Berhampore, had an add-on information. It is about the history of radio. Jagadish Chandra Bose, an Indian scientist, had made significant contributions to the development of radio. His experiments were contemporaneous with that of Guglielmo Marconi. He invented a crystal radio detector, waveguide, horn antenna, and other apparatuses.

Thank you readers for your valuable feedback. - Editor

GREAT BOOKS CONTEST

Winners of the Great Books Contest held in the May issue of Tell Me Why.

1. **Pridhvi S.S.** Kerala.
2. **Krishnendu Mandal** Uttar Pradesh.
3. **Dheeraj Manghnani** Rajasthan.
4. **Chittesh Avasthi** Punjab.
5. **Soumya Prakash Patra** Odisha.
6. **Suraj Shah** Gujarat.
7. **Rishabh Nandakumar** Kerala.
8. **Roxane Choksi** Maharashtra.
9. **Akash Sarangi** Jharkhand.
10. **Vishnu** Chattisgarh.

ANSWERS

1. Emily Brontë
2. T.S. Eliot
3. Fyodor Dostoyevsky
4. John Milton
5. Ernest Hemingway
6. Gabriel García Márquez

I Wonder Why?

Question of the Month

Can we fire a gun in space?

It is possible to fire a gun in space, even though space is vacuum and no oxygen is present there.

Modern guns have their own internal oxidisers. These oxidisers are the chemicals, that trigger the explosion of gunpowder. And this explosion, on the other hand, forces the firing of the bullet. That means we can fire a gun wherever we are in the universe and oxygen is not at all a requirement.

Though it is possible to fire a gun in space, the bullet won't travel any faster than it would on Earth. On Earth, gravity eventually pulls the bullet down, even if it doesn't hit anything. In space, where there is no gravity, the bullet could keep moving forever as long as it doesn't hit something.

Question sent by:
Neeraj Rao on e-mail

Send us your questions
E mail: **tellmewhy@mmp.in**

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WINNER OF NATIONAL AWARD

The NATIONAL AWARD for Outstanding Efforts in Science and Technology Communication Through Print Media, 2014 was won by TELL ME WHY and its sister publications BALARAMA DIGEST and BALARAMA. This award is instituted by the Department of Science and Technology of the Union Government.